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THESIS

USMC TACTICAL MOTOR TRANSPORT LIFT REQUIREMENTS MODEL

by

Scott Andrew Allen

March, 1995

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USMC TACTICAL MOTOR TRANSPORT LIFT REQUIREMENTS MODEL

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ABSTRACT

This thesis concentrates on developing a spreadsheet model that can be used by Marine logisticians in computing sustainment requirements and the resulting tactical motor transport lift requirements necessary to keep a notional sized maneuver element supported on a daily basis in the Marine Corps' projected maneuver warfare environment. Sustainment computations are limited to resupplying the maneuver element with food, water, fuel, and ammunition. Using an "add-in" simulation package the planning factors are allowed to take on a more realistic stochastic nature. From the simulation trial runs, distribution frequencies are generated; thus, enabling the planner to establish various customer service levels. For example, if the stated goal is to support the maneuver element with a minimum of 85 percent of their requirements then it is a simple procedure to analyze the pertinent distribution frequency and establish how many gallons of fuel, water, or short tons ammunition are required. The major finding of the thesis is the apparent inconsistency of consumption and usage factors used in computing fuel requirements for various end items, e.g., a five ton truck requiring 230 gallons daily compared to a M1A1 tank using 86.5 gallons.

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I. INTRODUCTION

A. BACKGROUND

The United States Marine Corps' philosophy for conducting and winning wars is based on rapid, flexible, and opportunistic maneuver; referred to as maneuver warfare. It is defined in Fleet Marine Force Manual 1 as "a warfighting philosophy that seeks to shatter the enemy's cohesion through a series of rapid, violent, and unexpected actions which create a turbulent and rapidly deteriorating situation with which he cannot cope." In order to support such a philosophy, maneuver forces are equipped with the most modern, mobile, and combat effective equipment available. The logistical support elements in direct support of the maneuver forces must be equally mobile and capable in order to provide the sustainment required to not only win the immediate battle, but achieve the overall strategic goal.

Marine Forces from a division, aircraft wing and service support group are organized into Marine Air-Ground Task Forces, commonly referred to as MAGTFs. Each MAGTF is task organized under a single command and structured to accomplish a specific mission. They are composed of a command element, ground combat element, aviation combat element, and combat service support element. The Marine Corps takes great pride in that "the MAGTF is the only fully integrated combined-arms component in the armed forces with a self-sustaining logistics capability." (FMFM-4, 1993, 1-1)

B. RESEARCH TOPIC

The motivation behind this thesis is that it is my opinion that Desert Shield/Storm is not an accurate barometer by which to judge the Marine Corps' logistical capabilities. A great portion of our success can be directly attributed to the hard work of our junior Marines, inferior opposition, and the good fortune that the ground war lasted only a few days and not to our superior logistical planning or capabilities. Additionally, it is unclear whether the combat service support element could have kept pace with the maneuvering combat forces and kept them properly supplied with their life-blood of fuel, ammunition, and rations if the ground war had lasted any longer or if there had been more than the token resistance presented.

Therefore, the objective of this thesis is to develop a model which can facilitate an investigation of the combat service support element's capability to sufficiently provide the necessary supply and the motor transport support required to provide a true self-sustaining logistics capability to the MAGTF. The model can assist in determining whether or not the Marine Corps is equipped to cope with the vast quantities of fuel and ammunition required to keep today's mechanized forces operating in the highly mobile environment envisioned for tomorrow's battles.

This model can be used by any Marine logistician to compute the basic sustainment requirements and the resulting tactical motor transport lift requirements necessary to keep a notional sized maneuver element supported on a daily basis in the Marine Corps' projected maneuver warfare environment. Sustainment computations will be limited to resupplying the maneuver element with food, water, fuel, and ammunition. I will also investigate what happens to the sustainment requirements when the planning factors are allowed to take on a more realistic stochastic nature instead of the deterministic values which are normally used.

C. CSS FUNDAMENTALS

A combat service support element (CSSE) is task-organized to provide a full spectrum of combat service support enabling the MAGTF to accomplish its mission. The range of combat service support provided by the CSSE includes supply, maintenance, transportation, deliberate engineering, health, postal, disbursing, automated information systems, exchange, legal, prisoners of war, and graves registration services. The CSSE varies in size from a Marine expeditionary unit (MEU) service support group (MSSG) to a force service support group (FSSG). The FSSG is a permanently structured command composed of eight battalions, with a strength of 416 officers and 7872 enlisted, whose mission is to provide general support to the MEF. The MSSG is the CSSE element for a MEU; it draws its personnel and equipment from the eight battalions in the FSSG and is task-organized for each specific deployment. A MSSG normally contains approximately 200 Marines.

D. LITERATURE REVIEW

Fleet Marine Force Manual (FMFM) 4, *Combat Service Support* and FMFM 4-1, *Combat Service Support Operations*, are used as the doctrinal basis for all combat service support assumptions in support of MAGTF operations at both the operational and tactical level. FMFM 4-9, *Motor Transport,* is used as the basis and standard operating procedures in planning motor transport support in support of MAGTF operations.

Reference data is collected primarily from Marine Air Ground Task Force Warplanning System II, (MAGTFII) and Marine Corps Order 8010.1E, *Class V(W) Planning Factors for Fleet Marine Force Combat Operations*. MAGTF II is a automated planning tool that is designed to improve and condense the operational planning process. Planners can develop force structures, tailor force lists , compute sustainment, and estimate the plan's sea and air lift requirements. Data was cross-referenced to Logistics Management Information Systems (LMIS), and where equipment compatibility allowed, to the *Staff Officers' Field Manual Organizational, Technical, and Logistical Data Planning Factors,* FM 101-10-1/2 , the U.S. Army's logistics planning "bible."

E. THESIS ORGANIZATION

Chapter II outlines and discusses the basis with which the model is developed. It delineates the source and considerations used in choosing the planning factors for calculating food, water, fuel, and ammunition requirements. A notional maneuver element built around a reinforced infantry regiment will be constructed as a representative force requiring logistical sustainment support. From this notional maneuver element, equipment and troop density lists will be computed and used as the basis with which to calculate the necessary sustainment supplies and resulting motor transport lift required to support the maneuver force.

Chapter III discusses the sustainment requirements analysis. Using a simulation package the various planning factors used to compute the sustainment package are simulated. The simulation portion of the thesis investigates the effects and the sensitivity of the planning factors when they are treated as stochastic in nature instead of deterministic. The chapter concludes with an analysis comparing the U.S. Army's method of computing a day-of-supply for fuel and the Marine Corps.

Chapter IV discusses the motor transport lift analysis. The sustainment requirements generated by the model developed in Chapter II and simulated in Chapter III are used to calculate a notional motor transport section for a representative combat service support detachment in support of the maneuver element.

Chapter V discusses the relevance of the model to today's tactical logistician and how it can be of assistance in detailed and contingency planning. In addition, it discusses the strengths of the model and its limitations. It concludes with a recommended area for further investigation into the use and source of the planning factors.

Appendix A is a glossary of commonly used terms broken down into two sections. The first section contains acronyms and abbreviations, the second section contains definitions, which whenever possible are Department of the Defense standard definitions. Appendix B is the troop list and a selected equipment density list for the notional maneuver element. Appendix C is the sustainment data used to calculate the class I, rations and water sustainment package. Appendix D contains the fuel consuming end items and their associated planning factors used to compute the class III, bulk fuel sustainment package. Appendix E contains the end items which utilize ammunition and their associated planning factors used to determine the class V(W), ground ammunition package. Appendix F contains the summary reports from the simulation runs for the various planning factors.

II. MODEL DEVELOPMENT

A. SYSTEM REQUIREMENTS

The spreadsheet portion of the model is built using Lotus 1-2-3 Release 4 for Windows. This is the standard spreadsheet application program for the Marine Corps. Crystal Ball version 3.0 developed by Decisioneering, Inc. is used for the simulation portion of the model. Crystal Ball is a add-in to either Lotus 123 Release 4 or Microsoft Excel version 4.0.

The strength and advantages of using Crystal Ball is that it allows the planner to go beyond the basic "what-if" analysis available in Lotus 1-2-3. Through Monte Carlo simulation procedures, averaged value planning factors are converted into a range of possible values thus giving a more accurate statistical picture of the forecasted requirements. With relative ease the planner can choose a distribution and its parameters for each planning factor or "assumption factor"; run a simulation and determine the effect on the expected results or "forecasted values". In addition, Crystal Ball can determine confidence intervals, trends, and be used to conduct sensitivity analysis.

B. COMBAT SERVICE SUPPORT

The emphasis for the model development and analysis is at the tactical level of combat service support. The combat service support (CSS) functions considered are supply and transportation; services which must be satisfactorily fulfilled, in turn enabling combat units to accomplish their mission. Within this realm logisticians consider two types of distribution: supply point and unit distribution. Supply point distribution is where the receiving unit is issued its supplies at a central point and is expected to move the supplies with its organic transportation. Unit distribution is where the receiving unit is issued supplies at its own location; in which case the issuing unit is responsible for providing transportation to the receiving unit. The receiving unit is then responsible for distribution within its own organization.

Ideally, supported units should always receive unit distribution. However, in reality the combat service support element (CSSE) never has the assets to provide such service; therefore, engaged units with minimal organic transportation receive the highest priority for unit distribution. Engaged units with a greater degree of organic transportation have a lesser priority. Unengaged units receive the lowest priority and operate under the supply point distribution method. Thus the distribution method used is a combination of both methods. For example, when a MEF is deployed as the MAGTF the FSSG would provide the division's maneuver elements with unit distribution; while requiring the division's remaining regiments and battalions to operate under the supply point distribution method.

Doctrine identifies two types of replenishment systems: pull and push. Pull systems require the user/consumer to requisition their desired support. This system provides only what the user needs, however, it does not anticipate needs and is somewhat slower in providing a timely response to the user's needs. The push system depends on reports and pre-determined replenishment factors. The CSSE pushes or "force-feeds" the consumer supplies based on reports of the user's on hand balances and/or previously agreed upon rates. This system better anticipates the consumers needs and relieves him of the need to requisition supplies. However, it can lead to excesses for the consumer and hinder him with the need of managing the excesses. It can also contribute to the waste of valuable transportation in moving unnecessary supplies. Similar to the choice of distribution methods, CSS operations are conducted under a combination of both types of replenishment systems.

When a force service support group deploys as the CSSE, the FSSG commander would normally establish combat service support detachments (CSSDs) in direct support of the division's maneuver elements. The CSSE would provide the transportation to deliver supplies and equipment to the subordinate CSSDs, thus operating under unit distribution. While the CSSDs would in turn provide the transportation to deliver the supplies and equipment to the maneuver elements. The delivering unit selects the mode of transportation; while ground transportation is the norm, aircraft are a viable alternative. However, aircraft are usually reserved for emergency/rapid resupplies as the tactical situation dictates and allows.

C. SCENARIO

The underlying tactical situation which the notional maneuver force is built upon is the deployment of a Marine Expeditionary Force as the MAGTF. Its mission is to conduct an amphibious assault and follow-on offensive operations in a temperate climate. The threat is considered to be primarily infantry, but there is a potential of reinforcement by unknown sources.

With this assumption a reinforced Marine division is the ground combat element and a force service support group is the combat service support element. Using standard doctrine, the division commander would task-organize notional maneuver forces built around an infantry regiment reinforced with a artillery battalion, a tank company, an amphibious assault vehicle (AAV) company, and a truck platoon; sometime referred to as a regimental landing team (RLT).

The CSSE commander determines that the best method of support is to task organize a Mobile CSSD (MCSSD) and assign it a direct support mission to the maneuver force. The MCSSD will be designed to be as mobile as possible to facilitate its ability move itself in its entirety on short notice and follow in trace of the supported RLT. The MCSSD will maintain one day-of-supply (DOS) of Class I, Class III, and Class V(W). The MCSSDs mission of direct support for the RLT is to ensure that the right supplies are available, as needed, and where needed. This requires a responsive, flexible, and highly capable CSS force.

1. Assumptions

For ease and clarity of the problem scenario and model, the following assumptions are made:

- The maneuver force does not have the organic transport capability to conduct supply point distribution, therefore, a policy of unit distribution is established by the MCSSD commander.

- Push replenishment will be the normal mode of operations.

- Aircraft use is at a premium, thus air resupply will be conducted only for emergency/rapid resupplies.

- All resupply operations from the MCSSD to the supported units are local or short haul.

- The CSSE commander has designated the MCSSD as its number one priority in that should any of its vehicles go down for maintenance for over 24 hours it will be immediately replaced.

- There is no nuclear, biological, or chemical threat.

- The Department of the Defense is capable of sourcing all the necessary supplies that the MAGTF requires at the operational level.

2. Limitations

The model is built upon the assumption of resupplying only classes I, III, and V(W). These are not the only items of concern though. Normal operations require the replenishment of other consumables and repairables, i.e., batteries for communication equipment and repair parts for vehicles. However, since rations, water, fuel, and ammunition are considered the most critical and the most cargo space intensive the model is constrained to those items. The model has a naturally built in safety factor which should help alleviate the problem of not considering other classes of supply in the overall lift requirements. In the calculations for rations and ammunition sustainment all requirements less than a standard unit of shipment or unit pack are rounded up to next unit pack, thus somewhat over estimating their projected footprints.

In calculating the transportation requirements for ammunition, compatibility is not considered. Because of safety regulations, selected items of ammunition can not be transported in the same vehicles. Therefore, there is the potential that ammunition sustainment requirements will need to be transported in less than full truck loads, and hence a possibility for under estimating the actual lift requirements for ammunition.

D. MANEUVER ELEMENT ORGANIZATION

The notional maneuver element is task-organized using the unit reference data located in MAGTF II; updated with the current MAGTF data library, dated December 1994. The cumulative force and equipment density list is built by extracting the tables of organization (T/O) and tables of equipment (T/E) for an infantry regiment, its associated headquarters company and infantry battalions, an artillery battalion, a tank company, an amphibious assault vehicle company, and a truck platoon. Appendix B lists the maneuver elements Troop Density Listing and Selected Equipment Density Listing.

Standard T/Os identify individual weapons for each member of the organization i.e., 9mm pistol or M16A2 rifle. However, MAGTF II while listing the respective weapon fails to calculate the total number of individual weapons in the equipment density listing. Instead it uses a percentage basis applied to the force population to determine the total number, by type of individual weapons.

E. CLASS I SUSTAINMENT

Class I sustainment is subsistence items and water. Subclassifications for class I are: in-flight rations, refrigerated subsistence, nonrefrigerated subsistence, and combat rations. Water is a critical commodity on the battlefield. It is necessary for personnel consumption and hygiene, cooking, maintenance, equipment operation, decontamination and other purposes. It is a common practice for planners to estimate 20 gallons per individual per day. This is only a gross estimate, Appendix C, Figure 1 provides more detailed planning factors broken down by specific uses and requirements per individual. Total water consumption is calculated by multiplying the force density by the sum of the appropriate usage factors resulting in a gallons per day requirement.

Class I sustainment is calculated using the troop list density of the supported unit. The tactical situation, ration type availability, and desires of the supported commander dictate the type of ration to be supplied. Appendix C, Figure 2 provides the characteristics of standard rations. For this scenario, rations will be limited to meals, ready-to-eat (MREs).

F. CLASS III SUSTAINMENT

Class III sustainment includes petroleum, oils, and lubricants. Next to ammunition, fuel could be the most critical logistical concern on the modern battlefield. Without fuel, today's mechanized forces do not move! Through modeling and usage data the Marine Corps has determined average rates for gallons used per hour and operating hours per day for each piece of equipment. Total fuel consumption is then arrived at by multiplying the equipment density times the number of gallons per hour and operating hours for each piece of equipment. The results are expressed in number gallons per day.

G. CLASS V(W) SUSTAINMENT

Marine logisticians are very capable and experienced in planning for, and meeting all the MAGTFs logistical needs except for perhaps ammunition. Not since Vietnam has the logistics pipeline been required to provide continuous ammunition resupply missions to engaged units. During Desert Shield/Storm, much experience was garnered in building and managing field ammunition supply points and the initial distribution of the ground combat element's (GCEs) basic allowance and subsistence load. However, because of the minimal resistance, our ability to conduct sustained ammunition resupply missions under combat conditions was not adequately tested. The logistics community may not be prepared to handle the shear bulk of ammunition our forces are capable of expending.

The class V(W) sustainment package is based upon the weapons density, duration of combat, and the anticipated intensity of conflict. The Marine Corps has established combat planning factors, (CPFs) for each anticipated combat scenario. The scenarios considered represent Marine units conducting an amphibious assault and follow-on combat operations against armor-heavy or infantry-heavy ground forces, along with insurgent forces in a low-intensity conflict. A weighted average planning factor, based on these three scenarios was developed for planning in an uncertain environment where the threat will be primarily infantry, but may be reinforced by unknown forces. The weighted average planning factor is calculated using three weights: the infantry-heavy threat CPF's were weighted twice, and the larger of the remaining CPF's were weighted once. The weighted average planning factor is based on the threat of greatest Marine Corps contribution, and ensures that the "worst case" requirements in support of the other scenarios are met. (MCO 8010.1E)

Each item of ammunition is identified by a Department of Defense Identification Code or DODIC. Each DODIC has a specific CPF or usage rate for each scenario; additionally, CPF rates are broken down by a GCE rate or other-than GCE rate. The other-than GCE rate applies to the command, aviation combat, and combat service support elements of the MAGTF. Therefore, to calculate the daily class V(W) sustainment package you multiply the weapons density by element for each DODIC by the appropriate CPF to determine the number of rounds required per day or day-of-supply, (DOS) for each DODIC. Next, this figure is compared to the standard unit pack; in all cases the DOS is rounded up to the nearest whole unit pack. This figure is then multiplied by the unit pack's weight to determine the number of pounds required daily for each DODIC. Finally, the weight required for each DODIC is totaled and divided by 2000 to determine the total number of short tons, (STONS) of ammunition to be resupplied daily.

III. SUSTAINMENT ANALYSIS

A. LOGISTICAL PLANNING

Standard procedure for logistical planners is to depend on the accuracy of reference data and planning factors in determining sustainment requirements. All too frequently the planning factors used are treated as if they are known with exactness. Thus the sustainment levels or "the requirements" are based on the troop/equipment density tables and the planning factors. While a veteran planner may rely upon personal experience to adjust and fine tune these figures, the planning factors are still used in a deterministic nature.

When the planning factors are considered in another light, such that they are only average values or perhaps stochastic, what is the net effect on the overall requirements? If the factors are average values, the best logisticians can do in meeting the actual demand is a 50% fill rate or customer service level. Any time logisticians only achieve a 50% satisfaction level, they can not expect to be in operation very long.

B. SUSTAINMENT CALCULATIONS UNDER THE TRADITIONAL METHOD

The first step in the model development is to use the inherent capabilities of a spreadsheet application program to automate the repetitive tasks explained in Chapter II for calculating the total sustainment requirements.

1. Class I Sustainment Calculations

In calculating daily water requirements, Figure 1 in Appendix C was used. Based upon the assumption that the maneuver element is on the offensive in a temperate climate subsisting on MREs there is not any water used for food preparation, heat treatment, centralized hygiene, or laundry. Appendix C, Class I Computations, contains detailed water sustainment calculations. A figure of 17,564 gallons is the daily water requirement.

Within the context of this model and scenario it is a simple procedure to calculate the proper rations sustainment. It is the number of meals per day times the number of personnel. Appendix C, Class I Computations, contains detailed rations sustainment calculations. A figure of 12,852 MREs equating to 23 pallets is the daily rations requirement.

2. Class III Sustainment Calculations

Using the cumulative equipment density list in Appendix B and each end item's associated consumption factor expressed in terms of gallons per hour (GAL/HR) and usage factors expressed in terms of operating hours (OP HR) a daily fuel requirement of 27,390 gallons of diesel and 2,389 gallons of gasohol was calculated. Appendix D lists the fuel consuming end items and their associated planning factors by fuel type: diesel and gasohol.

Reviewing the daily consumption rate for each end item three things stand out. First, the consumption factor for the M1A1 Main Battle Tank appears to be on the low side at

17.3 gallons per hour. This is even more noticeable when compared to the consumption factor of 11.5 gallons for any variant of the 5 ton truck or 16.6 gallons for the MK48 power train unit. Next, when reviewing the operating hours for the M1A1 tank, amphibious assault vehicles, TOW weapon carriers, and 5 ton trucks all items which are used jointly to provide combat forces with a means of mechanization, they have noticeably different operating times of 5, 10, 8, and 20 hours respectively. This appears to be an inconsistency. Finally, the primary factor driving the gasohol requirements is the consumption requirements of the squad stove at 2,237 gallons. This one item accounts for 94% of the total gasohol requirement. A consumption factor of 0.2 gallons per hour seems reasonable, however, a usage rate of 12 hours seems quite excessive from my personal experience.

3. Class V(W) Sustainment Calculations

Similar to the calculations for Class III requirements the first step in the ammunition sustainment calculations is to identify all the ammunition users from the equipment density listing in Appendix B. Using the appropriate combat planning factor for the specified scenario from Marine Corps Order 8010.1E; in this case the weighted average combat planning factors. The CPF is multiplied by the equipment density to determine a day-of-supply for ammunition for the RLT; a DOS of ammunition for the RLT equates to 164 short tons. Appendix E contains the ammunition requirements computations. It is broken down into three sections: Class V(W) Equipment Density Listing, Ammunition Requirements Computation, and Ammunition Footprint Computation.

In MCO 8010.1E select DODICs have a unit of issue other than by weapon. For example grenades are issued by the number of individuals, smoke pots by the number of infantry battalions, and mines by the number of divisions. All units of issue specified as a Marine division, engineer battalion, reconnaissance unit, or demolition squad are considered equal to zero. This is for simplicity since the RLT is only a portion of a division, they are in offensive operations, and there are not any engineers or reconnaissance elements task-organized to the RLT.

C. SUSTAINMENT CALCULATIONS UNDER SIMULATION

As stated in Chapter II the strength of using a simulation program is that it allows the planner to go beyond the basic "what-if" analysis available in spreadsheet applications. Crystal Ball extends the forecasting capability of the basic model by enabling the planner to assign distributions or a range of values to each planning factor or assumption factor, thereby, treating the planning factors as random variables. Thus the forecasted requirements can then be displayed as a range of possible outcomes with the probability of experiencing each outcome.

Crystal Ball allows the planner to choose from 12 different distributions. Only the normal, triangular, and beta distributions were considered as possible alternatives to match to the planning factors which are being simulated. In all instances the given planning factor serves as the mean and/or most likely occurrence.

Conditions for use of the normal distribution are:

- Some value such, as the planning factor is the most likely and mean of the distribution.
- The planning factor is as likely to be above the mean as below the mean.
- The planning factor is more likely to be near the mean than far away.

The normal distribution was tried as the underlying distribution for all of the planning factors simulated because of its ability to represent so many naturally occurring events. For the normal distribution Crystal Ball's default value of the mean divided by ten was accepted as the standard deviation. This was done because of the lack of availability of the actual standard deviation. The value can easily be changed to whatever the planner feels is appropriate. In the event the planning factor was near either an upper or lower limit the distribution was truncated at the limit. For example if the average operating hours is 20 hours the distribution would naturally exceed 24 hours; therefore, it is truncated at 24 hours.

Conditions for the triangular distribution are:

- The minimum value of the planning factor is fixed.
- The maximum value of the planning factor is fixed.
- The most likely value of the planning factor falls between the minimum and maximum values, such that any value near the minimum or maximum is less likely to occur than those near the most likely value.

The triangular distribution was tried as the underlying distribution for operating hours in the calculation for diesel fuel because of the lower and upper limit of 0 and 24 hours in a day, with the given planning factor as the most likely value to occur.

Conditions for the beta distribution are:

- The planning factor is a random value between 0 and a positive value.
- The shape of the distribution can be specified using two positive numbers - alpha and beta.

The beta distribution was also tried as the underlying distribution for operating hours in the calculation for diesel fuel with a scale from 0 to 24. The advantage in using the beta distribution is that you can shape the distribution by judiciously picking the values for alpha and beta. For this model the planning factor was set equal to the mode (X_m) or the most likely value to occur, alpha (α) was kept between 2 and 4, while beta (β) was determined by solving the equation:

$$\beta = \frac{24(\alpha - 1)}{Xm} - \alpha + 2$$

Crystal Ball allows the planner to determine how many trials to run for each simulation; for this model the number of trials used was 500. In addition, Crystal Ball provides the capability to conduct sensitivity analysis and determine which planning factors have the greatest influence upon the forecasted sustainment requirement. This is graphically depicted with the sensitivity charts in Appendix F. The larger the value associated with the planning factor in the chart the greater the relative influence on the forecasted value. The one disadvantage to the chart is that the planning factors are referenced by their cell number in the spreadsheet, thereby, making it difficult to interpret the chart without the spreadsheet.

1. Class I Sustainment Calculations

Only the normal distribution was used for simulating the planning factors used in calculating a DOS of water. Appendix F contains the pertinent data extracted from the simulation run. The sensitivity chart ranks the planning factors by their degree of correlation to the forecasted value. For example, as common sense would indicate, the planning factor with the largest value, personal hygiene (1.7), ranked with the highest degree of correlation in determining the total water requirements. Using the cumulative distribution function from the forecast output range the following fill rate or customer service level can be established:

Water Daily Sustainment Normal Distribution							
Fill Rate	50%	75%	80%	85%	90%	95%	100%
Gallons	17,529	18,144	18,366	18,645	18,813	19,230	20,325

Table 1. Water Requirements Summary

In this scenario there is little variance involved in the planning of rations sustainment since daily rations are limited to MREs. The key is to anticipate force reductions and additions in a timely manner to effect the amount of rations being pushed forward.

2. Class III Sustainment Calculations

In simulating the fuel consumption usage planning factors only the normal distribution was considered as the underlying distribution for both diesel and gasohol. The normal, triangular, and beta distributions were all tried as the underlying distribution for the operating hours planning factor for diesel fuel consuming end items. Again using the cumulative distribution function from the forecast output range for each simulation run the following fill rates can be established for each distribution type:

Diesel Fuel Daily Sustainment in Gallons by Distribution Type							
Fill Rate	50%	75%	80%	85%	90%	95%	100%
Normal	30,680	32,600	33,029	33,667	34,347	35,467	38,800
Triangular	28,800	32,583	33,375	34,680	35,925	37,150	44,600
Beta w/ α=2	29,486	33,475	34,375	35,400	36,300	37,500	44,550
Beta w/ α=3	28,400	31,917	32,790	33,450	34,650	36,000	41,400
Beta w/ α=4	28,507	31,467	32,267	33,289	34,333	35,867	39,200

Table 2. Diesel Fuel Requirements Summary

Appendix F contains the pertinent data extracted from each simulation run. For the triangular distribution and in all cases for the beta distribution the operating hours for the 5 ton truck was the primary factor in determining the overall diesel fuel requirement. In the case of the normal distribution both the consumption factor and usage factor for the 5 ton truck were the key factors in determining the overall diesel fuel requirement. As depicted in Figure 1 it makes very little difference what type distribution is chosen. They all approximate the normal distribution.

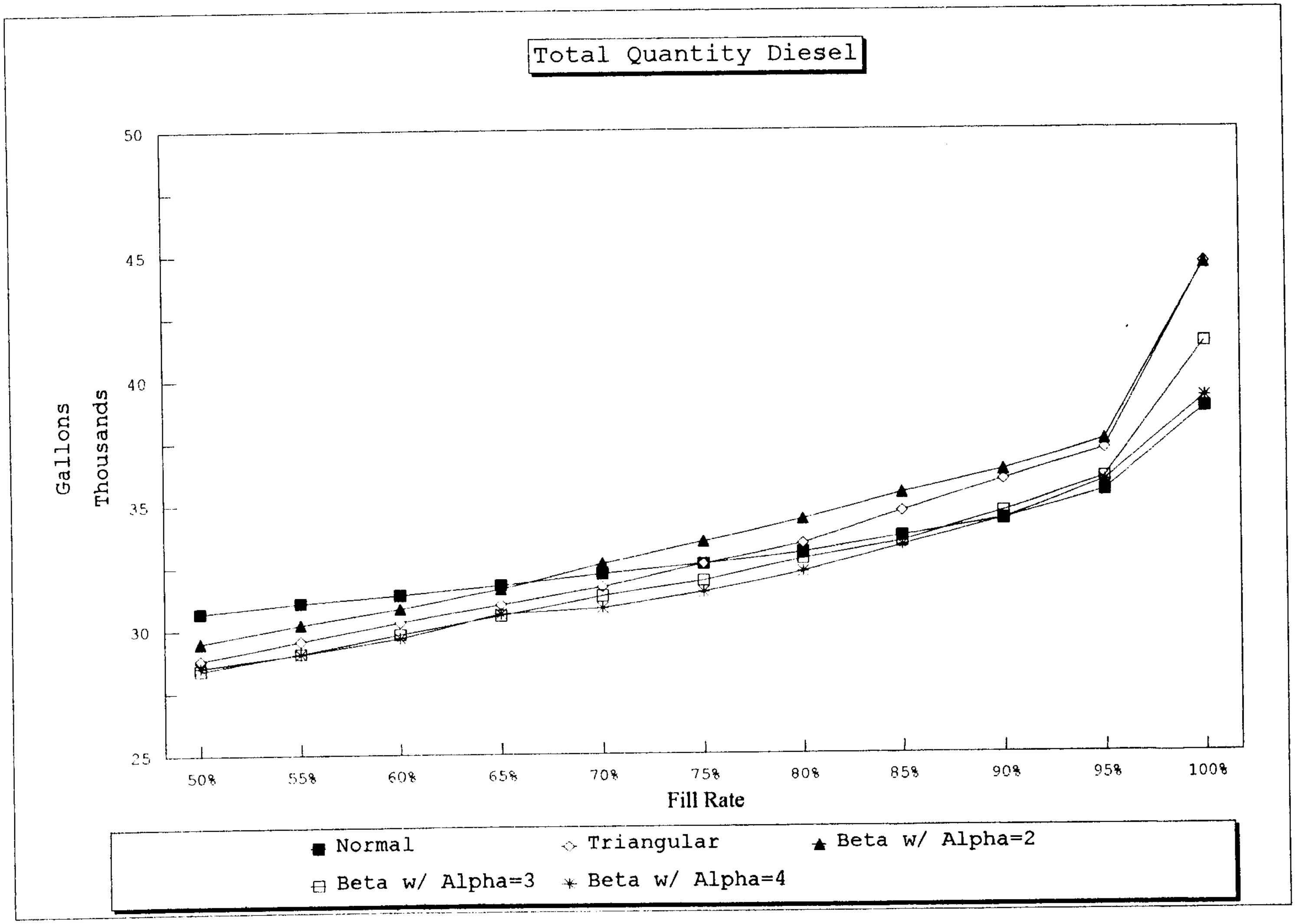


Figure 1. Simulated Diesel Fuel Fill Rate

The fact that the distribution chosen makes little or no difference, with the end result in each case mirroring the normal distribution, may be explained by the central limit theorem. In simple terms the central limit theorem states that regardless of the distribution of the planning factor, the distribution of the sum of the planning factors will tend to follow a normal curve as the number of planning factors grows large. Therefore, because the model essentially is just adding up numerous "averaged values" the choice of a normal distribution is a sound one. In addition, as previously stated the choice of a standard deviation is up to the planner, however, the net effect of the standard deviation will be a narrower overall range of possible forecasted requirements with a small standard deviation and a larger range with a larger standard deviation.

For gasohol-consuming end items the beta distribution was not considered for the operating hours planning factor for following reasons:

- At 8 percent, gasohol plays a relatively small role in the total daily fuel requirements.
- Based on my experience, gasohol plays a minor role in daily mission essential requirements.
- There are many similarities between the normal and triangular distributions.
- Because, in the case of the diesel fuel end items the lack of any evidence that distribution choice resulted in any significant results.

Appendix F contains the pertinent data extracted for both simulation runs. Using the triangular distribution for operating hours, the key factor in determining the total gasohol requirements was the operating hours for the squad stove. For the normal distribution both the operating hours and consumption factor for the squad stove played nearly equal importance in the overall requirements. The forecasted output range for both simulation runs is as follows:

Gasohol Fuel Daily Sustainment in Gallons by Distribution Type							
Fill Rate	50%	75%	80%	85%	90%	95%	100%
Normal	2,406	2,609	2,668	2,742	2,821	2,928	3,440
Triangular	2,406	3,043	3,318	3,511	3,786	4,429	5,400

Table 3. Gasohol Fuel Requirements Summary

3. Class V(W) Sustainment Calculations

The only distribution considered in simulating the combat planning factors for the daily ammunition requirements was the normal distribution. Again the default value of the mean divided by ten was accepted as the standard deviation. Appendix F contains the pertinent data from the simulation run. The top three CPFs by DODIC in determining the overall class V(W) requirements are D579 and D544 both 155MM projectiles and then D541 a 155MM charge. This is interesting because none of these DODICs have the heaviest individual daily weight. The forecasted output range for the simulation run is as follows:

Class V(W) Daily Sustainment							
Fill Rate	50%	75%	80%	85%	90%	95%	100%
STONS	163	166	167	168	169	170	176

Table 4. Ammunition Requirements Summary

D. U. S. ARMY FUEL CONSUMPTION CALCULATIONS

The Army calculates their daily fuel requirements primarily by a "type-unit-based" method for any organization larger than a battalion. FM 101-10-1/2 has class III data broken down by unit which identifies by fuel type what a unit's DOS requirements are. Using tables in FM 101-10-1/2 a planner is also able to estimate fuel requirements by equipment type; similar to the Marine Corps method. The Army uses the equipment type method for units which are small in nature with a known equipment density and for specially tailored task forces.

When computing fuel requirements by the equipment type method the first noticeable difference is that the Army distinguishes by equipment type, i.e., tracked vehicles-combat, tracked vehicles-other, wheeled vehicles, generators, etc.. The reason for this is that consumption factors are given by an average figure; by idling time, cross-country time, and secondary-road time for combat tracked vehicles, by miles or kilometers for wheeled vehicles, and by hours for all other types of equipment. The usage factor is then given by the appropriate time or distance for the given equipment type. However, where the Marine Corps just has one standard usage factor the Army breaks theirs down by geographical area, i.e., Korea, Europe, Alaska, Panama Canal Zone, and the continental United States (CONUS).

For example to compute a DOS of fuel for the M1A1 tank you multiple the equipment density by the sum of three different consumption factors, idling time, cross-country road time, and secondary-road time multiplied by their respective usage factor for the designated geographical area. For wheeled vehicles it is simply the consumption factor times the designated geographical areas usage factor.

For the comparison scenario CONUS usage factors were used in the calculations for a DOS via the Army's equipment type method. The representative DOS is per end item. Thus the total DOS for selected end items is the summation of the quantity of end items times the DOS per end item. Of particular interest is that the Marine Corps representative wheeled vehicles have a significantly higher daily consumption rate, while for the one tracked vehicle it is the opposite. The Marine Corps total DOS almost triples that computed with the Army's planning factors. The following table lists the comparable end items in both service's active inventories:

TAMCN	MODEL	QUANTITY	USMC DOS	ARMY DOS
D1016	M1008 TRK CARGO	20	40	3
D1059	M923-A1 TRK CARGO	71	230	10
D1110	M492AC TRK REFUELER	1	32	8
D1158	M998 HMMWV	128	14	4
E1888	M1A1 TANK 120MM	14	87	395
TOTAL DOS FOR SELECTED END ITEMS			20,172	6,820

Table 5. USMC vs. Army Diesel Fuel DOS Comparison

IV. MOTOR TRANSPORT LIFT REQUIREMENTS

The Marine Corps defines motor transport as a subfunction of transportation and considers it the most versatile mode of transport linking combat service support areas to combat units. Each organization in the MAGTF has their own motor transport assets used for their own internal requirements. Though it is the motor transport battalion in the FSSG that is organized to provide medium and heavy lift transportation in direct and general support of MAGTF operations. When directed, the motor transport battalion provides task-organized units to the CSSE to perform the required motor transport missions. (FMFM 4-9, 1992)

A. MCSSD MOTOR TRANSPORT ASSET REQUIREMENTS

In order to build the MCSSD's motor transport detachment, an analysis of the MCSSD's mission and the supported unit's capabilities and requirements is conducted. Vehicle assignments to detached CSS units is based on the following criteria: tactical scenario, mission requirements, and vehicle availability. As stated in the basic scenario in Chapter II, the MCSSD is assigned a direct support mission to the RLT. The CSSE commander determined that the MCSSD would be designed to be as mobile as possible so that it can move itself in its entirety on short notice and follow in trace of the supported RLT. The MCSSD will maintain a day-of-supply (DOS) of Class I, Class III, and Class V(W). The MCSSD is a priority commitment; if any of their vehicles are down for maintenance in excess of 24 hours they will be immediately replaced. The MCSSD will receive unit distribution from the CSSE and provide unit distribution to the RLT. All resupply missions by the MCSSD to supported units is local or short haul; therefore, they can be accomplished in a 24 hour period.

For simplicity, vehicle assignment to the MCSSD is done on a fair share basis from the CSSE's available resources. The only items considered are the MK48 power unit which tows the 22 1/2 ton MK14 trailer and the 20 ton MK17 trailer along with the M923 5 ton truck; these are the items which most frequently make up a CSSD's line haul capability. Fuel and water transportation is conducted using storage tank modules called sixcons; each type has a carrying capacity of 900 gallons. Additionally, road conditions and terrain dictate the number of sixcons which can be mobile loaded aboard the MK14 trailer; three to five are possible with one pump unit. In Desert Shield/Storm the standard operating procedures was three sixcons per trailer.

Based on my personal experience when moving pallets of MREs, vehicles reach their maximum volume capacity or are "cubed-out" before they reach their maximum weight capacity. It is the opposite for ammunition where the vehicle is "weighted-out" first.

1. Lift Requirements Under the Traditional Method

Using the sustainment requirements generated in Chapter II and the criteria set forth earlier in this chapter, Table 6 identifies the lift requirements generated to support the RLT using the sustainment planning factors in a deterministic manner. The MK14 trailers will be loaded with three sixcons. To meet the need of 27,390 gallons of diesel fuel just slightly over 30 sixcons are required. Instead of rounding up to 31 sixcons and having a MK14 trailer with just one sixcon on it and thus the need of an additional MK48 power train, the requirement was rounded down to 30 sixcons for economy of resources.

ITEM OF SUPPLY	REQUIREMENT	MK48	MK14	MK17	M923	WATER SIXCON	FUEL SIXCON
RATIONS	23 PALLETS	2	1	1			
WATER	17,564 GALS	7	7			21	
DIESEL	27,390 GALS	10	10				30
GASOHOL	2,389 GALS	1	1				3
AMMUNITION	164 STONS	7	6	1	3		
TOTAL		27	25	2	3	21	33

Table 6. DOS Lift Requirements Generated by CPFs

2. Lift Requirements Under Simulation

Using the simulated sustainment calculations generated in Chapter III with Crystal Ball, various customer service levels were established. Table 7 and 8 identify the lift requirements necessary to support the RLT when simulating the sustainment planning factors. Table 7 is a 85% customer service level; Table 8 a 100% customer service level. For both scenarios only three sixcons per MK14 trailer are planned on. In addition when determining the number of MK14 trailers, any time the number of sixcons required is less than a multiple of three, the requirement is rounded up to the next nearest multiple of three. This is done so that there is not any wasted space on a MK14 trailer, therefore, ensuring the most economical use of resources. For example, in Table 7 to meet the requirement of 33,667 gallons of diesel fuel, 37.4 sixcons are required; this number is rounded up to 39 sixcons to fully utilize the MK14 trailers lift capability.

ITEM OF SUPPLY	REQUIREMENT	MK48	MK14	MK17	M923	WATER SIXCON	FUEL SIXCON
RATIONS	23 PALLETS	2	1	1			
WATER	18,645 GALS	7	7			21	
DIESEL	33,667 GALS	13	13				39
GASOHOL	2,742 GALS	1	1				3
AMMUNITION	168 STONS	7	6	1	3		
TOTAL		30	28	2	3	21	42

Table 7. Lift Requirements For 85% Fill Rate

ITEM OF SUPPLY	REQUIREMENT	MK48	MK14	MK17	M923	WATER SIXCON	FUEL SIXCON
RATIONS	23 PALLETS	2	1	1			
WATER	20,325 GALS	8	8			24	
DIESEL	38,800 GALS	14	14				42
GASOHOL	3,440 GALS	1	1				3
AMMUNITION	176 STONS	8	6	2	3		
TOTAL		33	30	3	3	24	45

Table 8. Lift Requirements For 100% Fill Rate

In determining the amount of lift required to meet these service levels only the requirements for water and fuel have any significant effect in the number of assets required to achieve a fill rate better than 50% or that established by using the planning factors in a deterministic manner. This is because the lift required to move MREs does not vary and the range width for ammunition from a 50% fill rate to a 100% fill rate is only 13 short tons, less than a MK17 trailer load. Additionally, a key aspect in the number of MK14 trailers and thus MK48 power units required is not the amount of ammunition to be lifted but the number of sixcons. In all the cases the number of MK14 trailers required for sixcon lift is twice that of ammunition.

3. Lift Requirements Using Army Diesel Fuel CPFs

Using the data generated in Section D of Chapter III, Table 9 identifies the lift requirements when using Army diesel fuel consumption data where possible. As expected the required lift is significantly lower than that obtained when using the Marine Coprs planning factors in a deterministic manner.

ITEM OF SUPPLY	REQUIREMENT	MK48	MK14	MK17	M923	WATER SIXCON	FUEL SIXCON
RATIONS	23 PALLETS	2	1	1			
WATER	17,564 GALS	7	7			21	
DIESEL	14,038 GALS	6	6				18
GASOHOL	2,389 GALS	1	1				3
AMMUNITION	164 STONS	7	6	1	3		
TOTAL		23	21	2	3	21	21

Table 9. Lift Requirements Generated w/ Army CPFs

4. Historical Perspective

During Desert Shield/Storm, MCSSD-26 was assigned a very similar mission as that of the MCSSD in this thesis. They were in direct support of the Sixth Marine Regiment which was reinforced with a tank battalion of M60A1s, two AAV companies, an artillery battalion, a engineer company, and a truck platoon. Thus, making them significantly more mechanized than the RLT developed for this thesis.

The motor transport section of MCSSD-26 had a mobile line haul capability of 10,800 gallons of fuel and water and 165 short tons of ammunition. This is a significantly smaller fuel and water line haul capability than that which the model would have generated.

In my opinion MCSSD-26s' reduced capability was exposed two days after the ground war started when their on hand stockage levels were practically depleted and resupply was not effected on a timely basis. This did not become a factor due to the very short duration of the war and the static position established by Sixth Marines on the third day.

B. ASSET UTILIZATION RATE

In order to establish the CSSE's ability to provide the motor transport support necessary to provide the MAGTF with a truly "self sustaining logistics capability" an analysis of the lift assets to support one maneuver element and the amount of assets left over to support the remainder of the MAGTF must be done. Table 10 identifies the amount of assets required to support the maneuver force and the total number of assets available in the CSSE. Scenario A is using the planning factors in a deterministic manner. Scenarios B and C are based on the simulated planning factors and supporting the maneuver force at a 85 and 100% service level respectively. Scenario D is using the Army's planning factors in a deterministic manner when possible.

ITEM	NUMBER AVAILABLE	SCENARIO A DETERMINISTIC	SCENARIO B 85% FILL RATE	SCENARIO C 100% FILL RATE	SCENARIO D ARMY FACTORS
MK48	186	27	30	33	23
MK14	171	25	28	30	21
MK17	41	2	2	3	2
M923	113	3	3	3	3
WATER SIXCON	210	21	21	24	21
FUEL SIXCON	186	33	42	45	21

Table 10. Asset Utilization Comparison

All infantry organizations in the Marine Corps are organized around three combat units, i.e., three rifle companies in a battalion, three battalions in a regiment, and three regiments in a division. The artillery regiment, tank, and amphibious assault vehicle battalions each have three sub-units to support the infantry regiments. This configuration supports the standard offensive procedures of two units forward with one in reserve. Thus, in order for the FSSG to sufficiently support the division there is a need for not only one MCSSD but two organized in the same manner to adequately support both maneuver forces.

An additional issue is vehicle availability. Without fail all the vehicles a unit has are not available for daily use. This is attributed to preventive and corrective maintenance, accidents, and combat losses. The Army uses a figure of 83 percent availability for operational or short range planning, or a maximum sustained effort used for only a period of 30 days or less. For long range planning the figure drops to 75 percent. (Edwards, 1993) Figure 2 shows asset utilization considering two MCCSDs and a 83 percent vehicle availability for the MK48, MK14, and MK17.

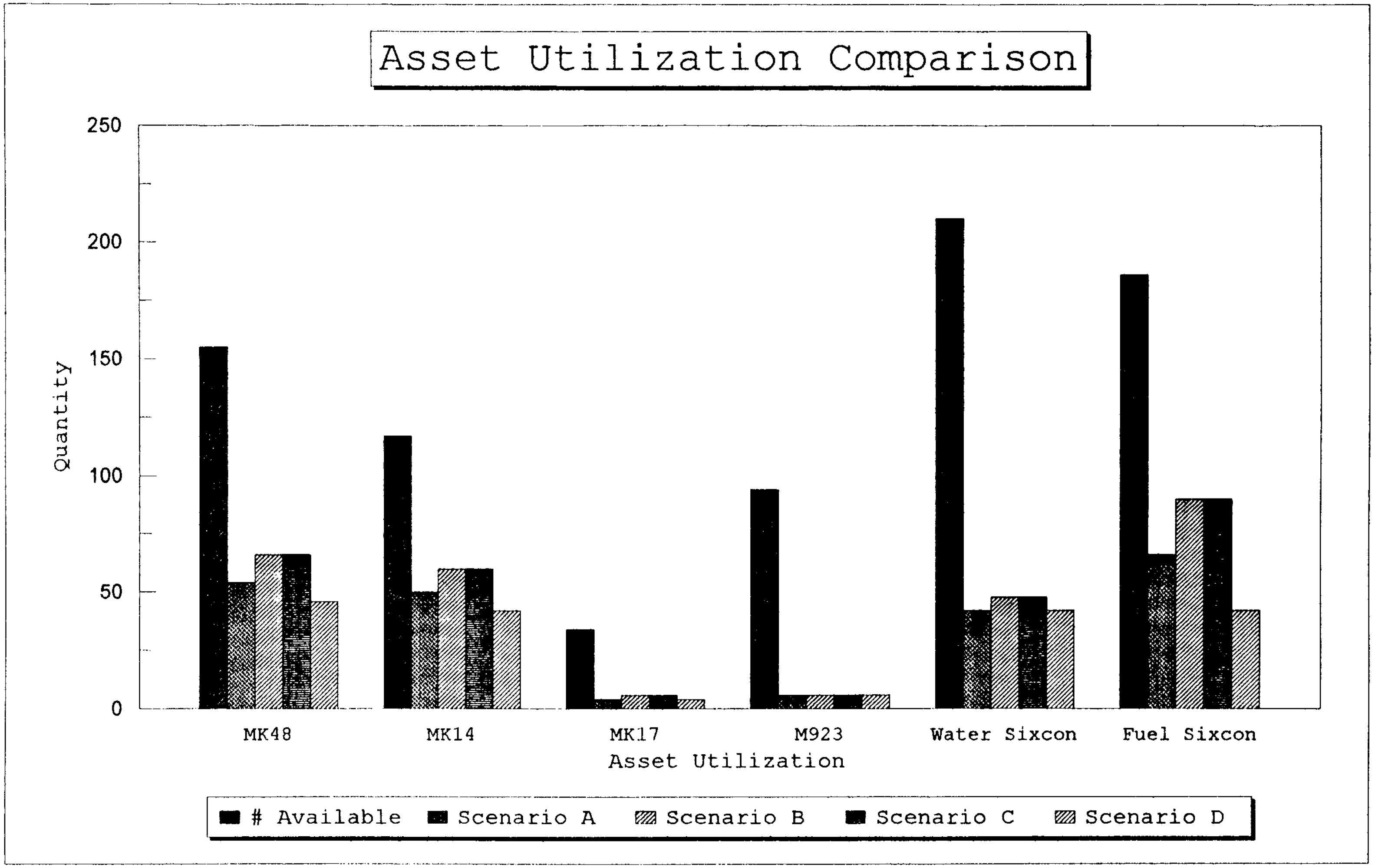


Figure 2. Asset Utilization by Scenario

From Figure 2 it appears that the CSSE should have enough assets to adequately support the remaining elements of the MAGTF at the tactical level. This is a rough estimate based on the assumption that the remaining units are operating under the supply point distribution method. This is a feasible assumption considering that the remaining ground combat elements and the aviation combat element operate from semi-permenant positions behind the forward edge of the battle area. However, the CSSE's motor transport capabilities will be severely strained as distances between units become greater thus making multiple daily resupply missions with the same assets infeasible. Furthermore, the role and employment of the light armored infantry and reconnaissance battalions could over-extend the CSSE's fuel line-haul capabilities if those units must operate under the unit distribution method.

Two issues are not addressed in this study: First, not only must the CSSE have the ability to transport the maneuver element's sustainment requirements to the MCSSD for further delivery to the RLT but it must also provide the sustainment requirements required for the MCSSD's operations. This can be a significant amount. A DOS of 9,686 gallons of diesel is required for the MCSSD, based upon only the line haul motor transport assets identified in Scenario A in Table 10 and ignoring any other assets the MCSSD would require in their day-to-day operations. Thus, increasing the overall amount of diesel fuel that must be provided daily to the MCSSD by 33 percent.

Second, the amount of assets which must be used to operational source and deliver the necessary supplies to the CSSE is not considered. This can be a significant amount of line-haul, as was required during Desert Shield/Storm where it was accomplished with a significant amount of host nation support; in general a very risky source at best.

V. RECOMMENDATIONS AND CONCLUSIONS

> The more I see of war, the more I realize how it all depends on administration and transportation... It takes little skill or imagination to see where you would like your army to be and when; it takes much knowledge and hard work to know where you can place your forces and whether you can maintain them there. A real knowledge of supply and movement factors must be the basis of every leader's plan; only then can he know how and when to take risks with those factors, and battles are won only by taking risks. (A.C.P. Wavell as cited by Van Creveld, 1977)

This quote is more applicable today and in the future than when it was original made. As the Marine Corps prepares for tomorrow's battles its combat forces enjoy a tremendous capability in rapid assault movement. I believe the question, "Can the combat service support structure keep pace and provide the quality of service which the supported units expect?" can be answered "Yes, at the tactical level of CSS operations."

A. FINDINGS AND CONCLUSIONS

The spread sheet model developed enables the planner to rapidly calculate class I, III, and V(W) sustainment requirements for any sized MAGTF, operating in any climate, and in any kind of tactical environment. With a basic understanding of probability, the simulation add-in allows the planner to go beyond the "best-guess" solution derived with the basic planning factors to a more complete picture of the range of requirements in a stochastic environment. Using the distribution frequencies generated with Crystal

Ball, various customer service levels can be established. For example, if the stated goal is to support the RLT with a minimum of 85 percent of their requirements then it is a simple procedure to analyze the pertinent distribution frequency to establish how many gallons of fuel, water, or short tons ammunition are required. Stated another way, based upon actual stockage levels the logistics planner can state with a sense of certainty at what percentage the RLT's requirements can be supported.

The strength of the model is that it gives the planner a tool to quickly determine sustainment requirements with a clearer picture of what factors are driving the overall requirements at a more detailed level than MAGTF II is capable of. Motor transport assets can then be assigned in an economical manner to best serve the MAGTFs focus of effort.

The weakness of the model is the quality of the planning factors. The accuracy of the forecasted sustainment requirements depend upon the reliability of the basic planning factors. In the case of fuel consumption data, I believe there is a need for further research to solidify the data. For example, the five ton truck has a higher daily fuel requirement than the M1A1 tank. Gasohol requirements are driven solely by the squad stove and appears to be an excessively high usage rate. There is a wide margin of difference between the Marine's and Army's data for like items, more than can be rationalized by a difference in the tactical employment of forces or operating procedures.

Contrary to popular belief, even though ammunition sustainment does require a substantial amount of lift, when the planning factors are simulated the range of the resulting forecast is relatively small. Thus ammunition sustainment plays a minor role in the marginal lift requirements at various service levels.

A side issue is the accuracy of the data in MAGTF II, updated with the December 1994 MAGTF Data Library. For example, the table of equipment for a tank company is listed as 11 M1A1 tanks. One tank officer stated that as recently as 1994 the table of equipment for a company was 14 tanks. This may be a single incident, however, it does cause a certain amount of mistrust in the data.

B. RECOMMENDATION

A more detailed evaluation of the fuel consumption planning factors should be conducted. Instead of using one figure for the usage factor per vehicle type a better way might be to establish usage data by vehicle type and by the type of unit. This could be done in a manner similar to the way ammunition planning factors are broken down by a GCE rate and other-than-GCE rate; thereby, accounting for differences in operational use by combat organizations and service support organizations. Furthermore, it appears to be a sound approach to use a similar method as the Army's in computing tracked vehicle consumption by idling time, cross-country time, and secondary-road time.

APPENDIX A. GLOSSARY

Section I. Acronyms and Abbreviations

ACE	aviation combat element
CE	command element
CPF	combat planning factor
CSS	combat service support
CSSD	combat service support detachment
CSSE	combat service support element
DODIC	Department of Defense Identifier Code
DOS	day(s) of supply
FMFM	Fleet Marine Force manual
FSSG	force service support group
GCE	ground combat element
MAGTF	Marine Air-Ground Task Force
MEF	Marine expeditionary force
MEU	Marine expeditionary unit
MHE	materials handling equipment
MCSSD	mobile combat service support detachment
MOS	military occupational specialty
MSSG	MEU service support group
POL	petroleum, oil, and lubricants
RLT	regimental landing team
SIXCON	six containers (together)
STON	short ton
TAMCN	table authorized material control number
T/E	table of equipment
T/O	table of organization

Section II. Definitions

A

aviation combat element - The MAGTF element that is task organized to provide all or a portion of the functions of Marine Corps aviation in varying degrees based on the tactical situation and the MAGTF mission and size. The ACE is organized around an aviation headquarters and varies in size from a reinforced helicopter squadron to one or more Marine aircraft wing(s).

C

command element - The MAGTF headquarters. It is a permanent organization consisting of the commander, general and special staff sections, headquarters section, and the necessary internal communications and service support sections. The CE provides the required command, control, and coordination for the execution of operations by the other three elements.

combat service support - The essential logistic functions, activities, and tasks necessary to sustain all elements of an operating force in an area or operations. Combat service support includes but is not limited to administrative services, chaplain services, civil affairs, finance, legal service, health services, military police, supply, maintenance, transportation, construction, troop construction, acquisition and disposal of real property, graves registration, and other logistics functions

combat service support element - The MAGTF element that is task organized to provide the full range of combat service support necessary to accomplish the MAGTF mission. The CSSE varies in size from a MSSG to a FSSG.

combat service support detachment - A separate task organization of combat service support assets formed for the purpose of providing rearming, refueling, and/or repair capabilities to the MAGTF or designated subordinate element; e.g., a battalion conducting independent operations or an aircraft squadron operating at a remote airfield.

G

ground combat element - The MAGTF element that is task organized to conduct ground combat operations. It is built around an infantry unit ranging in size from a reinforced battalion to one or more reinforced Marine Divisions. In addition, the GCE also contains the appropriate combat service support units for it's immediate logistical requirements.

F

force service support group The combat service support element of the MEF. It is a permanently organized Fleet Marine Force command charged with providing combat service support beyond the organic capabil- ities of supported units of the MEF. If supporting a force of greater size, additional assets are necessary to augment its capabilities. Although permanently structured with eight functional battalions, task organizations from those battalions would normally support MEF operations over a wide geographic area.

M

Marine Air-Ground Task Force A task organization of Marine forces (division, aircraft wing and service support groups) under a single command and structured to accomplish a specific mission. The MAGTF components will normally include command, aviation combat, ground combat, and combat service support elements (including Navy Support Elements).

Marine Air-Ground Task Force II - MAGTF II is a system that allows MAGTF planners to select and tailor MAGTF force structures, estimate sustainment, and estimate airlift/sealift requirements for plan feasibility.

Marine Air-Ground Task Force data library (MDL) - The MDL programs encompass source planning management and technical data extracted from mainframe data bases/systems on a monthly basis. The MDL is the origin of all standard source data elements used by the MAGTF/LOGAIS family of systems, and contains critical elements such as tables of organization/equipment, ammunition consumption factors, and aviation data.

APPENDIX B. TROOP DENSITY LISTING

MOS	NOMENCLATURE	QUANTITY
0000	REL PROG ASST	4
0121	ASST PERSONNEL CHIEF	18
0131	UNIT DIARY CLERK	20
0151	ADMIN CLERK	59
0161	POSTAL CLERK	1
0170	PERS OFFICER	4
0180	S-1/ADJUTANT	5
0193	PERSONNEL CHIEF	10
0202	S-2	6
0231	INTELLIGENCE CHIEF	15
0302	INFANTRY OFFICER	96
0306	ASST S-3/MARINE GUNNER	4
0311	INFANTRYMAN	1162
0331	SQUAD LEADER	267
0341	SECTION LEADER	282
0351	SECTION LEADER	261
0352	SQUAD LEADER	120
0369	OPERATIONS CHIEF	98
0402	S-4	12
0411	MAINT MGT CHIEF	20
0430	ASST S-4/EMBARK OFFICER	1
0431	LOG NCO	12
0491	LOGISTICS CHIEF	2
0802	ARTILLERY OFFICER	38
0803	SURVEY OFFICER	1
0811	AMMUNITION MAN	195
0844	OPERATIONS ASSISTANT	49
0848	PLT SGT/OPNS CHIEF	10
0861	OBSERVER LIAISON CHIEF	27
1100	REGT NG LIAISON OFFICER	3
1316	METAL WORKER/VTR CREWMAN	3
1802	TANK COMMANDER	5
1803	AAV COMMANDER	5
1812	TANK LEADER	75
1833	COMPANY GUNNERY SERGEANT	135
2100	REGIMENTAL MEDICAL OFFICER	8
2110	PC/CO MAINT OFFICER	1
2111	ARMORER	21
2120	REGIMENTAL ORD OFFICER	2
2131	ARTY WPN REPAIRER	7
2141	ASST MAINT CHIEF	34
2146	MAINTENANCE CHIEF	6
2149	MAINTENANCE CHIEF	1
2171	TOW MAINT CHIEF	13
2311	AMMUNITION TECH	17
2502	PLT CDR/REGT COMM OFFICER	6
2512	WIRE SUPV	60
2515	SWITCHBD SUPV	6
2519	WIRE CHIEF	5
2531	FLD RADIO OPER	261

2537	RADIO CHIEF	13
2542	COMM CENTER MAN	5
2549	COMM CENTER CHIEF	1
2585	PLRS OPERATOR	2
2591	COMM CHIEF	5
2811	TELEPHONE REPMAN	8
2818	MICRO COMPUTER TECH	6
2841	RADIO RPRMN	27
2861	SECTION CHIEF	5
2889	GND RADAR RPRMAN	1
3002	ASST S-4/ SUPPLY OFFICER	6
3043	SUPPLY CHIEF	34
3051	GEN WHSEMAN	23
3361	SUBS SUP MAN	9
3381	MESS MGMT CHIEF	88
3502	MOTOR TRANSPORT OFFICER	7
3510	MOTOR TRANSPORT MAINT OFFICER	1
3521	AUTOMOTIVE MECH	61
3523	WRECKER/AUTO MECH	2
3529	MOTOR TRANSPORT CHIEF	9
3531	DRIVER	149
3537	MT OPS CHIEF	13
4066	COMPUTER SYSTEM SPECIALIST	2
4100	CHAPLAIN	5
5702	NBC DEF OFF	5
5711	NBC DEF NCO/TRNG NCO	9
7207	ASST S-3/AIR OFF	9
8404	REGT CHIEF	201
8421	CAREER PLANNER	5
8425	ADVANCED HOSP CORPSMAN	6
8432	ENVRNMNTL SAN TECH	4
8541	CHIEF SCOUT SNIPER	51
9906	COMMANDING OFFICER	1
9910	HUMAN AFFAIRS OFFICER	2
9911	CAREER PLANNING OFFICER	2
9915	HUMAN AFFAIRS NCO	1
9916	UAV OPERATOR	5
9969	AIR OFFICER	1
9999	SERGEANT MAJOR/1ST SERGEANT	27
Total		4284

Number of pistols is 25% total troop density minus unarmed chaplains minus squad automatic weapons. Therefore, number of pistols is 25%*(4284-5-339) = 985.

Number of rifles is 75% total troop density minus unarmed chaplains minus squad automatic weapons. Therefore, number of rifles is 75%*(4284-5-339) = 2955.

The percentages are based off the defualt assumption used by MAGTF II in calculating personel weapons.

SELECTED EQUIPMENT DENSITY LISTING

TAMCN	NOMENCLATURE	QUANTITY
A1930	RADIO SET	22
A1935	RADIO SET	19
A2183	RADIO TERMINAL SET	4
B0465	DECONTAMINATING APPARATUS	5
B0472	DEMOLITION EQUIPMENT, INDIV	41
B0595	15 KW ELECTRIC POWER DISTIBUTION	1
B0730	GENERATOR SET, 3 KW, 60 HZ SKID-MTD	7
B1280	LIGHT SET GENERAL ILLUMINATION	4
B1580	PUMP MODULE, FUEL (SIXCON)	3
B1620	PUMP SET, 65 GPM, 50 FT HEAD	2
B1650	REFRIGERATION UNIT, F/100 CU FT	12
B1710	REFRIGERATOR, RIGID BOX 350 CU FT	7
B1830	SAW, CHAIN, ONE MAN PORTABLE	1
B2085	STORAGE TANK MODULE, FUEL (SIXCON)	7
B2123	TACTICAL INTELLIGENCE IMAGERY	3
B2566	TRUCK, FORKLIFT, ROUGH TERRAIN	5
B2685	WELDING MACHINE, ARC, TRL-MTD	1
C5200	LANTERN SET, GASOLINE	78
D0200	MOTORCYCLE, UTILITY 2-WHEEL	8
D0209	POWER UNIT, FRONT, 12 1/2 TON	1
D1002	TRK AMB, 2 LITTER, SOFT TOP, 1 1/4	8
D1016	TRUCK, CARGO, 1 1/4 TON DIESEL 4X4	20
D1059	TRUCK, CARGO, 5T, 6X6 W/O WINCH	71
D1110	TRUCK,TANK FUEL SERV'G 1200 GAL	1
D1125	TRK TOW CARRIER, W/SA, 1 1/4 TON	48
D1158	TRUCK, 5/4 TON, HIGH MOBILITY 4X4	128
D1159	TRK, UTILITY, ARMT CARR W/SA 1 1/4	50
D1212	TRUCK, WRECKER, 5T 6X6	2
E0640	HOWITZER, LT TOWED, 105MM, W/E	12
E0665	HOWITZER, MEDIUM, TOWED 155MM	18
E0796	ASSAULT AMPHIBIOUS VEHICLE, COMMAND	3
E0846	ASSAULT AMPHIBIOUS VEHICLE, PERSONNEL	43
E0856	ASSAULT AMPHIBIOUS VEHICLE, RECOVERY	1
E0870	LASER, INFRARED OBSERVATION SET	117
E0890	LAUNCHER, GRENADE, 40MM	3
E0892	LAUNCHER, GRENADE 40MM	371
E0915	LAUNCHER ASSAULT ROCKET 83MM (SMAW)	54
E0935	LAUNCHER, TUBULAR, F/GM TOW WEAPON	48
E0960	MACHINE GUN, LIGHT, SQUAD, AUTOMATIC	339
E0980	MACHINE GUN, CAL. 50, BROWNING	84
E0991	MACHINE GUN, 7.62M -F/LVT	4
E0993	MACHINE GUN, 7.62MM	113

E0994	MACHINE GUN, 40MM	100
E0995	MACHINE GUN, 50 CALIBER	25
E0996	BLADE, MINE CLEARING	4
E0998	MACHINE GUN 7.62MM LH	22
E1065	MORTAR, 60MM LWCMS	27
E1095	MORTAR,MEDIUM EXTENDED RANGE	24
E1151	NIGHT VISION GOGGLES, INDIVIDUAL	341
E1153	NIGHT VISION SIGHT, TRACKER	48
E1158	NIGHT VISION SIGHT, INDIVIDUAL	357
E1159	NIGHT VISION SIGHT, CREW SERVED	54
E1377	RECOVERY VEHICLE, FULL TRACKED, MED	2
E1379	REGULATOR,CHARGING ACCUMULATOR	1
E1441	RIFLE (IMPROVED) 5.56MM	11
E1460	RIFLE, SNIPER, 7.62MM, W/EQUIP	24
E1760	SHOTGUN, 12 GAUGE	36
E1888	TANK, COMBAT, FT, 120MM GUN	11
E3175	TRACKER, INFRARED, GM, DRAGON	24

APPENDIX C. CLASS I DATA

Figure 1

Water Consumption Planning Factors
(Gallons Per Person Per Day)

Uses	Climate		
	Hot	Temperate	Cold
Drinking requirements	3	1.5	2
Heat treatment	0.2	0	0
Personal hygiene [1]	1.7	1.7	1.7
Centralized hygiene [2]	1	1	1
Food preparation [3]	0.0-4.5	0.0-4.5	0.0-4.5
Laundry [4]	2.1	2.1	2.1
Waste (10 percent)	0.8-1.3	0.7-1.1	0.7-1.2

Source: FM 101-10-1/2

Footnotes:

1) This figure includes water for shaving daily, brushing teeth three times a day, washing hands, and taking sponge baths daily. For periods of less than 7 days, the figure is 0.7 gallon; the water is used for shaving so that masks will fit.

2) This figure provides water for one shower a week.

3) The actual factor to use depends on the ration policy in the theater. No water is needed for meals (ready-to-eat). B rations require 0.5 gallons per meal per Marine for rehydration and kitchen sanitation. If individual mess equipment is used, 1.0 gallons per Marine is required to sterilize utensils and clean up.

4) This figure allows for one clothing exchange per week.

Figure 2

Characteristics of Standard Rations
Packaging Information

	Contents per package or case	Gross weight per package or case (pounds)	Volume per case (CU FT)	Avg wt per meal/unit including packing (LB)
Meal, ready-to-eat, individual [1]	12 meals	17.6	0.83 per case	1.47
Food packet, long-range patrol [2]	40 packets	36	1.84 per case	0.9
Ration Supplement sundries pack [3] (1 pack per 100 persons per day)	1 packet	41	1.67 per case	0.83
Field Ration A [4]				2.41
Standard B Ration [5]				1.28
T-Ration (Tray Packs) [6]				2.58

Source: FM 101-10-1/2

Footnotes:

1) Designed for use as individual meal packets or in multiples of three for a completion ration. This packet is not to be used over extended periods.

2) Issued to troops under combat conditions where resupply may be uncertain for as long as 10 days. Because the packet is designed for individual use, it is suitable for tactical feeding, which requires dispersion. The principal menu component is dehydrated and may be eaten as is with drinking water or may be rehydrated rapidly with hot or cold water. Eight different menus are available.

3) Composed of items necessary to the health and comfort of troops; e.g., essential toilet articles, tobacco, and confections that usually are obtained at an exchange. This packet is made available in theaters of operation for issue, pending establishment of adequate service facilities.

APPENDIX D. CLASS III REQUIREMENTS COMPUTATION

Diesel

TAMCN	NOMENCLATURE	QTY	GAL/HR	OP HR	TOT
A1650	ANTENNA COUPLER GROUP	0	0.300	24	0
A1930	RADIO SET	22	0.700	8	123
A1935	RADIO SET	19	1.700	8	258
A2183	RADIO TERMINAL SET	4	1.700	8	54
A2294	SHELTER, NONEXPENDABLE	0	0.040	24	0
B0055	BATH SHOWER UNIT EXPEDITIONARY	0	5.000	6	0
B0060	BATH UNIT, TRLR MTD	0	9.000	8	0
B0355	COMPACT/DITCHER	0	0.020	10	0
B0391	CONTAINER, HANDLER, ROUGH TERRAIN	0	12.000	8	0
B0395	COMPRESSOR AIR 250 CFM TRL-MTD	0	3.500	4	0
B0399	CRANE, RT, ROUGH TERRAIN, HYDRAUL	0	6.000	4	0
B0444	CRANE, WHEEL MTD, RT 7 1/2T -GROVE	0	3.000	8	0
B0590	EXCAVATOR, HYDRAULIC, MULTIPURPOSE	0	6.000	4	0
B0630	FLOODLIGHT SET	0	0.750	6	0
B0685	FUEL SYS AMPHIB ASSUALT, 600,000 GAL	0	35.000	20	0
B0730	GENERATOR SET, 3 KW, 60 HZ SKID-MTD	7	0.600	20	84
B0891	GENERATOR SET, 10KW, 60HZ, SKID-MTD	0	3.000	20	0
B0921	GENERATOR SET, 10 KW, 400HZ, SKID-MTD	0	3.000	20	0
B0953	GENERATOR SET, 30KW, 60HZ, SKID-MTD	0	4.500	20	0
B0971	GENERATOR SET, 30KW, 400HZ, SKID-MTD	0	3.000	20	0
B1016	GENERATOR SET, 60KW 400HZ SKD-MTD	0	6.000	20	0
B1021	GENERATOR SET, 60KW, 60HZ, SKID-MTD	0	6.000	20	0
B1045	GENERATOR SET, 100KW/60HZ, SKID-MTD	0	12.000	20	0
B1082	GRADER, ROAD, MOTORIZED	0	4.000	8	0
B1226	LAUNDRY UNIT, FIELD	0	10.000	20	0
B1326	MIXER CONCRETE, TRLR MTD	0	2.000	10	0
B1785	ROLLER, COMPACTOR, VIBRATORY	0	4.000	8	0
B1922	SCRAPER-TRACTOR, WHEELED	0	6.000	8	0
B1945	SHOP EQUIP, CONTACT MAINT, TRUCK	0	3.000	8	0
B2460	TRACTOR, FULL TRACKED, W/ANGLE BLADE	0	4.000	8	0
B2462	TRACTOR, MEDIUM, FULL TRACKED	0	6.000	10	0
B2482	TRACTOR, ALL WHEEL DRIVE W/ATTACHMENT	0	4.000	8	0
B2560	TRUCK, FORKLIFT	0	3.000	12	0
B2565	TRUCK, FORKLIFT, ROUGH TERRAIN	0	4.000	12	0
B2685	WELDING MACHINE, ARC, TRL-MTD	1	4.000	4	16
C4525	DATA PROCES' SET FORCE ASC MED SCALE	0	12.000	23	0
D0090	CLEANER, STEAM PRESSURE JET, TRLR	8	0.500	6	24
D0190	LUBRICATING AND SERVICING UNIT	1	1.000	6	6
D0200	MOTORCYCLE, UTILITY 2-WHEEL	8	1.700	20	272
D0209	POWER UNIT, FRONT, 12 1/2 TON, 4X4	1	16.660	20	333
D0215	SEMI-TRAILER REFUELER, 5000 GAL	0	1.500	3	0
D0320	SHOP SET, AUTOMOTIVE	0	5.330	1	0
D0340	SHOP SET, AUTOMOTIVE	0	10.660	1	0
D0360	SHOP SET, AUTOMOTIVE SUPPLY #2	0	10.660	1	0
D0918	TRUCK AMBULANCE 1 1/4 4X4	0	2.000	20	0
D1001	TRK AMB, 4 LITTER ARMD, 1 1/4 TON	0	1.700	6	0
D1002	TRK AMB, 2 LITTER, SOFT TOP, 1 1/4	8	1.700	6	82
D1016	TRUCK, CARGO, 1 1/4 TON DIESEL	20	2.000	20	800
D1059	TRUCK, CARGO, 5T, 6X6 W/O WINCH	71	11.500	20	16330
D1061	TRUCK, CARGO 5T EXTRA LONG WHEEL	0	11.500	20	0

D1064	TRUCK AIRCRAFT CRASH	0	15.000	20	0
D1072	TRUCK, DUMP, 5T 6X6 WO/W	0	11.500	20	0
D1105	TRUCK, SHELTER CARRIER DIESEL, 4X4	0	2.000	20	0
D1110	TRUCK,TANK FUEL SERV'G 1200 GAL	1	5.330	6	32
D1125	TRK TOW CARRIER, W/SA, 1 1/4 TON	48	1.700	8	653
D1134	TRUCK, TRACTOR, 5T 6X6 WO/W	0	11.500	20	0
D1158	TRUCK, 5/4 TON, HIGH MOBILITY 4X4	128	1.700	8	1741
D1159	TRK, UTILITY, AMT CARR W/SA 1 1/4	50	1.700	8	680
D1180	TRUCK UTILITY, SHELTER CARRIER	0	1.900	8	0
D1190	TRUCK VAN 2 1/2 TON	0	5.330	4	0
D1212	TRUCK, WRECKER, 5T 6X6	2	13.000	20	520
E0150	BRIDGE, ARMORED VEHICLE LAUNCHED	0	16.100	5	0
E0796	ASSAULT AMPHIBIOUS VEHICLE, COMMAND	3	9.000	10	270
E0846	ASSAULT AMPHIBIOUS VEHICLE, PERSONNEL	43	9.000	10	3870
E0856	ASSAULT AMPHIBIOUS VEHICLE, RECOVERY	1	9.000	10	90
E0942	LAV ANTI-TANK	0	7.000	10	0
E0946	LAV COMMAND AND CONTROL (BN)	0	7.000	10	0
E0947	LAV LIGHT ASSAULT 25MM	0	7.000	10	0
E0948	LAV LOGISTICS	0	7.000	10	0
E0949	LAV MORTAR	0	7.000	10	0
E0950	LAV MAINTENANCE/RECOVERY	0	7.000	10	0
E1032	METEROLOGICAL DATA SYSTEM (MDS)	0	0.700	20	0
E1377	RECOVERY VEHICLE, FULL TRACKED, MED	2	20.000	5	200
E1660	SHOP SET	0	5.330	1	0
E1680	SHOP SET, MACHINE BASIC	0	5.330	1	0
E1710	SHOP SET, ARTY	0	5.330	1	0
E1720	SHOP SET, SMALL ARMS	0	5.330	1	0
E1875	TANK COMBAT FT 105MM GUN	0	16.100	5	0
E1876	TANK, COMBAT, FT, W/M9 BULLDOZER	0	16.100	5	0
E1888	TANK, COMBAT, FT, 120MM GUN	11	17.300	5	952
U3195	PILE DRIVER	0	1.800	10	0

Total Qty Diesel in Gallon 27390

Gasohol

TAMCN	NOMENCLATURE	QTY	GAL/HR	OP HR	TOT
B0020	ANALYTICAL PHOTOGRAMMETRIC POSITION	0	0.600	20	0
B0060	BATH UNIT, TRLR MTD	0	0.500	8	0
B0360	COMPRESSOR, RECIPROCATING POWER	0	2.000	4	0
B0465	DECONTAMINATING APPARATUS, PD	5	3.000	6	90
B1135	HELICOPTER EXPEDIENT REFUELING SYSTEM	0	1.000	15	0
B1620	PUMP SET, 65 GPM, 50 FT HEAD	2	0.500	12	12
B1830	SAW, CHAIN, ONE MAN PORTABLE	1	0.500	6	3
C5200	LANTERN SET, GASOLINE,	78	0.050	12	47
J3193	ROCK DRILL/BREAKER GASOLINE	1	0.420	2	1
K4940	STOVE, GASOLINE, BURNER, W/CASE	932	0.200	12	2237

Total Qty Gasohol in Gals 2389

APPENDIX E. CLASS V(W) REQUIREMENTS COMPUTATION

Equipment Density Listing

TAMCN	NOMENCLATURE	QUANTITY
B1298	LINE CHG LAUNCH KIT TRLR MTD	0
B1315	MINE CLEARING LAUNCHER	0
E0150	BRIDGE, ARMORED VEHICLE LAUNCHED	0
E0310	DRAGON DAY/NIGHT TRACKER	0
E0640	HOWITZER, LT TOWED, 105MM, W/E	0
E0665	HOWITZER, MEDIUM, TOWED 155MM, M198	18
E0796	ASSAULT AMPHIBIOUS VEHICLE, COMMAND	3
E0846	ASSAULT AMPHIBIOUS VEHICLE, PERSONNEL	43
E0856	ASSAULT AMPHIBIOUS VEHICLE, RECOVERY	1
E0890	LAUNCHER, GRENADE, 40MM	3
E0892	LAUNCHER, GRENADE 40MM	371
E0915	LAUNCHER ASSAULT ROCKET 83MM (SMAW)	54
E0935	LAUNCHER, TUBULAR, F/GM TOW WEAPON	48
E0940	LAV AIR DEFENSE	0
E0941	LNCHR, ZERO LENGTH, GM, HAWK	0
E0942	LAV ANTI-TANK	0
E0944	LAV ASSAULT GUN	0
E0946	LAV COMMAND AND CONTROL (BN)	0
E0947	LAV LIGHT ASSAULT 25MM	0
E0948	LAV LOGISTICS	0
E0949	LAV MORTAR	0
E0950	LAV MAINTENANCE/RECOVERY	0
E0960	MACHINE GUN, LIGHT, SQUAD, AUTOMATIC	339
E0961	MACHINE GUN, 7.62MM	0
E0980	MACHINE GUN, CAL. 50, BROWNING	88
E0991	MACHINE GUN, 7.62M -F/LVT-	4
E0992	MACHINE GUN, 7.62MM, F/TANKS	0
E0993	MACHINE GUN, 7.62MM	115
E0994	MACHINE GUN, 40MM	100
E0995	MACHINE GUN, 50 CALIBER	25
E0998	MACHINE GUN 7.62MM LH	22
E1065	MORTAR, 60MM LWCMS	27
E1095	MORTAR,MEDIUM EXTENDED RANGE	24
E1140	MULTIPLE LAUNCH RKT SYS (MLRS)	0
E1180	PISTOL 45 CAL	0
E1250	PISTOL 9MM	985
E1353	RECHARGING UNIT, CARBON DIOXIDE	0
E1375	RECOVERY VEHICLE FT LIGHT	0
E1377	RECOVERY VEHICLE, FULL TRACKED, MED	2
E1400	REVOLVER, CAL 38	0
E1441	RIFLE (IMPROVED) 5.56MM	2955
E1460	RIFLE, SNIPER, 7.62MM, W/EQUIP	24
E1760	SHOTGUN, 12 GAUGE	36
E1837	STINGER NIGHT SIGHT	0
E1875	TANK COMBAT FT 105MM GUN	0
E1876	TANK, COMBAT, FT, W/M9 BULLDOZER	0
E1888	TANK, COMBAT, FT, 120MM GUN	14
E3175	TRACKER, INFRARED, GM, DRAGON	24
INDIV	INFANTRY BATTALION	9
INDIV	INDIVIDUAL	4279
INDIV	MARINE DIVISION	0
INDIV	DEMOLITION SQUAD	0
INDIV	DEMOLITION SET	41
INDIV	ENGINEER BATTALION	0
INDIV	RECONNAISSANCE UNIT	0

Ammunition Requirements Computation

DODIC	NOMENCLATURE	TAMCN	NOMENCLATURE	GCE TOTAL	CPF RATE	DOS
A011	CTG, 12GA, 00 BUCK	E1764	SHOTGUN, AUTO, COMBAT	36	0.6333	23
A059	CTG, 5.56MM BALL, M855	E1441	RIFLE, 5.56MM, M16A2	2955	18.3200	54136
A063	CTG, 5.56MM TRACER, M856	E1441	RIFLE, 5.56MM, M16A2	2955	2.4600	7269
A064	CTG, 5.56MM LKD, 4&1	E0960	MACHINEGUN, 5.56MM (SAW), M249	339	127.8567	43343
A131	CTG, 7.62MM LKD, 4&1	E0150	BRIDGE, ARMORED VEHICLE LAUNCHER	0	178.9400	0
A131	CTG, 7.62MM LKD, 4&1	E0796	AAVC7A1	3	182.4200	547
A131	CTG, 7.62MM LKD, 4&1	E0856	AAVR7A1	1	178.9400	179
A131	CTG, 7.62MM LKD, 4&1	E0940	LAV AIR DEFENSE	0	178.9400	0
A131	CTG, 7.62MM LKD, 4&1	E0942	LAV ANTI-TANK	0	150.1467	0
A131	CTG, 7.62MM LKD, 4&1	E0944	LAV ASSAULT GUN	0	150.1500	0
A131	CTG, 7.62MM LKD, 4&1	E0946	LAV COMMAND AND CONTROL	0	178.9400	0
A131	CTG, 7.62MM LKD, 4&1	E0947	LAV LIGHT ASSAULT 25MM	0	182.4167	0
A131	CTG, 7.62MM LKD, 4&1	E0948	LAV LOGISTICS	0	178.9400	0
A131	CTG, 7.62MM LKD, 4&1	E0949	LAV MORTAR IN LAI BN	0	173.7533	0
A131	CTG, 7.62MM LKD, 4&1	E0949	LAV MORTAR IN LAR BN	0	173.7533	0
A131	CTG, 7.62MM LKD, 4&1	E0950	LAV MAINT/RECOVERY	0	178.9400	0
A131	CTG, 7.62MM LKD, 4&1	E0993	MACNINEGUN, 7.62MM, M60E3	115	157.8700	18155
A131	CTG, 7.62MM LKD, 4&1	E1875	TANK, CMBT, 105MM GUN, M60A1	0	345.5800	0
A131	CTG, 7.62MM LKD, 4&1	E1888	TANK, CMBT, FT, 120MM GUN	14	358.0700	5013
A136	CTG, 7.62MM BALL, MATCH	E1460	RIFLE SNIPER, 7.62MM	24	9.0133	216
A363	CTG, 9MM BALL	E1250	PISTOL 9MM	985	0.4800	473
A400	CTG,.38 CAL BALL	E1400	REVOLVER 38 CAL	0	0.4800	0
A475	CTG,.45 CAL BALL	E1180	PISTOL 45 CAL	0	0.4800	0
A518	CTG, CAL 50 SLAP	E0846	AAVP7A1	43	61.2633	2634
A518	CTG, CAL 50 SLAP	E0980	MACHINEGUN, 50 CAL, M2	88	34.8300	3065
A518	CTG, CAL 50 SLAP	E1888	TANK, CMBT, FT, 120MM GUN	14	74.8433	1048
A576	CTG,.50 CAL LKD, 4&1 f/M2	E0846	AAVP7A1	43	142.9400	6146
A576	CTG,.50 CAL LKD, 4&1 f/M2	E0980	MACHINEGUN, 50 CAL, M2	88	81.2800	7153
A576	CTG,.50 CAL LKD, 4&1 f/M2	E1375	RECOVERY VEHICLE FT LIGHT	0	81.2800	0
A576	CTG,.50 CAL LKD, 4&1 f/M2	E1377	RECOVERY VEHICLE FT MEDIUM	2	81.2800	163
A576	CTG,.50 CAL LKD, 4&1 f/M2	E1888	TANK, CMBT, FT, 120MM GUN	14	174.6333	2445
A590	CTG,.50 CAL LKD, 4&1 f/M85	E1875	TANK, CMBT, 105MM GUN, M60A1	0	222.3600	0
A606	CTG, 50 CAL (RAUFOSS)	E1470	SNIPER RIFLE 50 CAL	0	7.7900	0
A974	CTG, 25MM APDS-T	E0947	LAV LIGHT ASSUALT 25MM	0	28.9533	0
A975	CTG, 25MM HEI-T	E0947	LAV LIGHT ASSUALT 25MM	0	102.6567	0
B504	CTG, 40MM GSP	E0892	LAUNCHER, GRENADE 40MM, M203	371	0.1500	56

B505	CTG, 40MM RSP	E0892	LAUNCHER, GRENADE 40MM, M203	371	0.0700	26
B506	CTG, 40MM RED SMK	E0892	LAUNCHER, GRENADE 40MM, M203	371	0.0700	26
B508	CTG, 40MM GRN SMK	E0892	LAUNCHER, GRENADE 40MM, M203	371	0.0600	22
B509	CTG, 40MM YEL SMK	E0892	LAUNCHER, GRENADE 40MM, M203	371	0.0700	26
B535	CTG, 40MM WSP	E0892	LAUNCHER, GRENADE 40MM, M203	371	0.2233	83
B542	CTG, 40MM LKD, HEDP, M430	E0846	AAVP7A1	43	75.0400	3227
B542	CTG, 40MM LKD, HEDP, M430	E0994	MACHINEGUN, 40MM, MK-19	100	72.4833	7248
B546	CTG, 40MM HEDP, M433	E0892	LAUNCHER, GRENADE 40MM, M203	371	2.3633	877
B642	CTG, 60MM HE W/MOF M734	E1065	MORTAR, 60MM LWCMS	27	10.2333	276
B643	CTG, 60MM HE W/FZ PD M935	E1065	MORTAR, 60MM LWCMS	27	23.8833	645
B646	CTG, 60MM SMK WP M722	E1065	MORTAR, 60MM LWCMS	27	6.1700	167
B647	CTG, 60MM ILLUM M721	E1065	MORTAR, 60MM LWCMS	27	10.1900	275
C380	CTG, 120MM APFSDS(DU), M829A1	E1888	TANK, CMBT, FT, 120MM GUN	14	1.8900	26
C445	CTG, 105MM HE, w/o FZ	E0640	HOWITZER TOWED 105MM M101A1	0	96.1800	0
C477	CTG, 105MM SMK, w/o FZ, (WP)	E0640	HOWITZER TOWED 105MM M101A1	0	9.6200	0
C479	CTG, 105MM SMK, w/o FZ (BE)	E0640	HOWITZER TOWED 105MM M101A1	0	3.3700	0
C508	CTG, 105MM HEAT, M456A2	E0944	LAV ASSUALT GUN	0	4.6100	0
C508	CTG, 105MM HEAT, M456A2	E1875	TANK, CMBT, 105MM GUN, M60A1	0	2.6500	0
C524	CTG, 105MM APFSDS(DU), M833	E0944	LAV ASSUALT GUN	0	4.4933	0
C524	CTG, 105MM APFSDS(DU), M833	E1875	TANK, CMBT, 105MM GUN, M60A1	0	2.6000	0
C542	CTG, 105MM ILLUM, M301	E0640	HOWITZER, TOWED 105MM, M101A1	0	7.6900	0
C787	CTG, 120MM HEAT-MP-T, M830	E1888	TANK, CMBT, FT, 120MM GUN	14	1.7967	25
C868	CTG, 81MM HE, M821, w/MOF (UK)	E0949	LAV MORTAR IN LAI BN	0	26.8533	0
C868	CTG, 81MM HE, M821, w/MOF (UK)	E0949	LAV MORTAR IN LAR BN	0	21.5233	0
C868	CTG, 81MM HE, M821, w/MOF (UK)	E1095	MORTAR, MEDIUM EXTENDED RANGE	24	24.8433	596
C869	CTG, 81MM HE M889, w/PD (UK)	E0949	LAV MORTAR IN LAI BN	0	62.6600	0
C869	CTG, 81MM HE M889, w/PD (UK)	E0949	LAV MORTAR IN LAR BN	0	50.2167	0
C869	CTG, 81MM HE M889, w/PD (UK)	E1095	MORTAR, MEDIUM EXTENDED RANGE	24	57.9700	1391
C870	CTG, 81MM SMK, M853, (RP)	E0949	LAV MORTAR IN LAI BN	0	7.7900	0
C870	CTG, 81MM SMK, M853, (RP)	E0949	LAV MORTAR IN LAR BN	0	20.1767	0
C870	CTG, 81MM SMK, M853, (RP)	E1095	MORTAR, MEDIUM EXTENDED RANGE	24	7.7900	187
C871	CTG, 81MM ILLUM, M871	E0949	LAV MORTAR IN LAI BN	0	15.8200	0
C871	CTG, 81MM ILLUM, M871	E0949	LAV MORTAR IN LAR BN	0	20.1767	0
C871	CTG, 81MM ILLUM, M871	E1095	MORTAR, MEDIUM EXTENDED RANGE	24	15.8200	380
C995	LCHR & CTG, 84MM, M136 (AT-4)	INDIV	INFANTRY BATTALION	9	10.9233	98
D003	CHG, SPOTTING F/D563	E0665	HOWITZER, TOWED 155MM, M198	18	2.6910	48
D501	PROJ, 155MM ADAMS-L	E0665	HOWITZER, TOWED 155MM, M198	18	1.4200	26
D502	PROJ, 155MM ADAMS-S	E0665	HOWITZER, TOWED 155MM, M198	18	2.4767	45
D505	PROJ, 155MM ILLUM, M485E2	E0665	HOWITZER, TOWED 155MM, M198	18	5.8200	105
D510	PROJ, 155MM HE CLGP, M712	E0665	HOWITZER, TOWED 155MM, M198	18	0.4900	9

D514	PROJ, 155MM RAAMS-S	E0665	HOWITZER, TOWED 155MM, M198	18	2.2733	41
D515	PROJ, 155MM RAAMS-L	E0665	HOWITZER, TOWED 155MM, M198	18	1.5900	29
D528	PROJ, 155MM SCREENING WP,M855	E0665	HOWITZER, TOWED 155MM, M198	18	2.4300	44
D532	CHG, 155MM RB (Z8), M203A1	E0665	HOWITZER, TOWED 155MM, M198	18	19.9377	359
D533	CHG, 155MM RB (Z7R), M119A2	E0665	HOWITZER, TOWED 155MM, M198	18	18.0952	326
D540	CHG, 155MM GB, M3A2	E0665	HOWITZER, TOWED 155MM, M198	18	10.0624	181
D541	CHG, 155MM WB, M4A2	E0665	HOWITZER, TOWED 155MM, M198	18	43.2084	778
D544	PROJ, 155MM HE, M107B2	E0665	HOWITZER, TOWED 155MM, M198	18	19.2800	347
D550	PROJ, 155MM SMK WP, M110A1	E0665	HOWITZER, TOWED 155MM, M198	18	2.6300	47
D563	PROJ, 155MM DPICM, M483A1	E0665	HOWITZER, TOWED 155MM, M198	18	26.9100	484
D579	PROJ, 155MM HE-RA, M549A1	E0665	HOWITZER, TOWED 155MM, M198	18	5.6700	102
D864	PROJ, 155MM DPICM(ER), M864	E0665	HOWITZER, TOWED 155MM, M198	18	12.0133	216
G826	GRENADE SMK IR SCRN, M76	E0846	AAVP7A1	43	2.9700	128
G826	GRENADE SMK IR SCRN, M76	E0942	LAV ANTI-TANK	0	2.9667	0
G826	GRENADE SMK IR SCRN, M76	E0944	LAV ASSUALT GUN	0	2.9700	0
G826	GRENADE SMK IR SCRN, M76	E0946	LAV COMMAND & CONTROL	0	2.9700	0
G826	GRENADE SMK IR SCRN, M76	E0947	LAV LIGHT ASSUALT 25MM	0	2.9700	0
G826	GRENADE SMK IR SCRN, M76	E0949	LAV MORTAR IN LAI BN	0	2.9700	0
G826	GRENADE SMK IR SCRN, M76	E0949	LAV MORTAR IN LAR BN	0	2.9700	0
G826	GRENADE SMK IR SCRN, M76	E1377	RECOVERY VEHICLE, FT, MEDIUM	2	2.9700	6
G826	GRENADE SMK IR SCRN, M76	E1875	TANK, CMBT, 105MM GUN, M60A1	0	3.1100	0
G826	GRENADE SMK IR SCRN, M76	E1888	TANK, CMBT, FT, 120MM GUN	14	3.1100	44
G881	GRENADE FZ F/PRACT GREN	INDIV	INDIVIDUALS	4279	0.0610	261
G930	GRENADE HC SMOKE, M8A1	INDIV	INDIVIDUALS	4279	0.0049	21
G940	GRENADE GREEN SMK, M18A1	INDIV	INDIVIDUALS	4279	0.0049	21
G945	GRENADE YEL SMK, M18A1	INDIV	INDIVIDUALS	4279	0.0049	21
G950	GRENADE RED SMK, M18A1	INDIV	INDIVIDUALS	4279	0.0023	10
G955	GRENADE HAND	INDIV	INDIVIDUALS	4279	0.0049	21
H104	RKT POD, 298MM, MLRS, TACT, M26	E1140	MULTIPLE LAUNCH RKT SYS (MLRS)	0	10.3200	0
HX05	RKT, 83MM HEDM, SMAW	E0915	LNCHER ASSLT ROCKET 83MM (SMAW)	54	0.8900	48
HX06	RKT, 83MM HEAA, SMAW	E0915	LNCHER ASSLT ROCKET 83MM (SMAW)	54	0.8900	48
J143	RKT/MTR 5"F/LINCHG, MK22-4	B1298	LINE CHG LAUNCH KIT TRLR MTD	0	0.3000	0
J143	RKT/MTR 5"F/LINCHG, MK22-4	B1315	MINE CLEARING LAUNCHER	0	1.0000	0
K092	MINE, ANTI-PERS, M16	INDIV	MARINE DIVISION	0	166.2300	0
K143	MINE, ANTI-PERS, M18A1	INDIV	MARINE DIVISION	0	94.2900	0
K180	MINE, ANTI-TANK HVY, HE, M15	INDIV	MARINE DIVISION	0	72.2100	0
K181	MINE, ANTI-TANK HVY, M21	INDIV	MARINE DIVISION	0	92.8800	0
K250	MINE, A/T NON-METALLIC, M19	INDIV	MARINE DIVISION	0	8.1667	0
K867	SMK POT FLT/GRND, M4A1	INDIV	INFANTRY BATTALION	9	0.9133	8
L283	SIG, SMK/ILLUM, MK124-0	INDIV	RECONNAISSANCE UNIT	0	0.3033	0

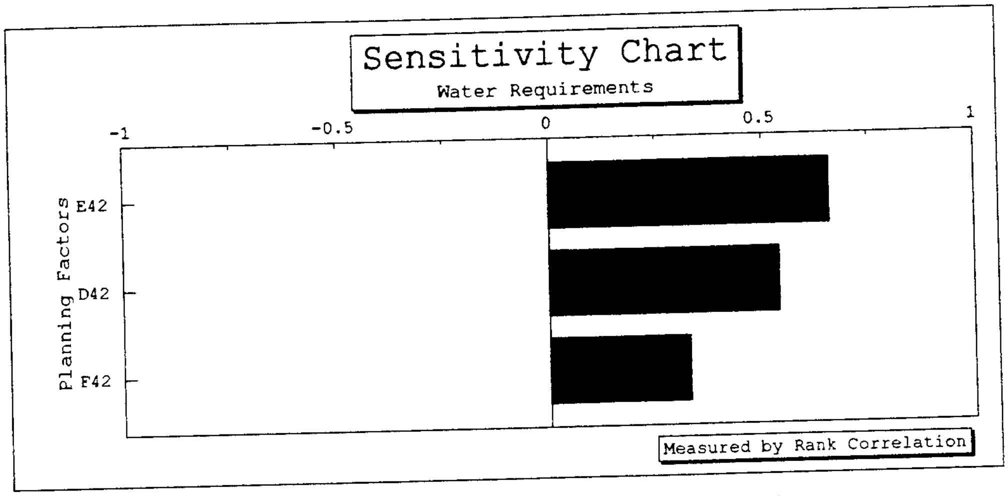
L306	SIG, ILL GRND RSC	INDIV	INDIVIDUALS	4279	0.0010	4
L307	SIG, ILL GRND WSC	INDIV	INDIVIDUALS	4279	0.0021	9
L311	SIG, ILL GRND RSP	INDIV	INDIVIDUALS	4279	0.0009	4
L312	SIG, ILL GRND WSP	INDIV	INDIVIDUALS	4279	0.0043	18
L314	SIG, ILL GRND GSC	INDIV	INDIVIDUALS	4279	0.0023	10
L323	SIG, SMK RED PARA	INDIV	INDIVIDUALS	4279	0.0007	3
L324	SIG, SMK GRN PARA	INDIV	INDIVIDUALS	4279	0.0007	3
L495	FLARE SURFACE TRIP, M49A1	INDIV	INDIVIDUALS	4279	0.0146	63
M023	CHG DEMO, 1.25 LB, C-4, M112	INDIV	MARINE DIVISION	0	11.0300	0
M028	BANGALORE TORPEDO, M1A1	INDIV	MARINE DIVISION	0	13.3500	0
M032	CHG 1-LB BLK TNT	INDIV	DEMOLITION SQUAD	0	4.0400	0
M039	CHG 40-LB CRATERING	INDIV	MARINE DIVISION	0	4.0553	0
M130	CAP BLASTING SPL-ELECTRIC	INDIV	DEMOLITION SQUAD	0	4.6167	0
M131	CAP BLASTING NON-ELECTRIC	INDIV	DEMOLITION SET	41	8.3283	341
M420	CHG, SHAPED 15/LB	INDIV	MARINE DIVISION	0	15.7500	0
M421	CHG, SHAPED 40/LB	INDIV	MARINE DIVISION	0	11.3000	0
M456	CORD DETONATING	INDIV	DEMOLITION SET	41	26.4567	1085
M591	DYNAMITE M-1	INDIV	ENGINEER BATTALION	0	96.3000	0
M670	FUSE TIME BLASTING, M700	INDIV	DEMOLITION SET	41	13.8633	568
M757	CHG DEMO ASSY, M183	INDIV	DEMOLITION SET	41	0.5000	21
M766	FUSE LIGHTER, M60	INDIV	DEMOLITION SET	41	5.0130	206
M913	LINEAR DEMO CHG, M58A4	B1298	LINE CHG LAUNCH KIT TRLR MTD	0	0.3000	0
ML03	MULTI-PURP FIR DEV	INDIV	DEMOLITION SET	41	13.8367	567
ML25	LINEAR DEMO CHG, M68	B1315	MINE CLEARING LAUNCHER	0	1.0000	0
N289	FUZE, ET M762	E0640	HOWITZER TOWED 105MM M101A1	0	11.6130	0
N289	FUZE, ET M762	E0665	HOWITZER, TOWED 155MM, M198	18	57.6800	1038
N290	FUZE, ET M767	E0640	HOWITZER TOWED 105MM M101A1	0	12.0240	0
N290	FUZE, ET M767	E0665	HOWITZER, TOWED 155MM, M198	18	4.0705	73
N340	FUZE, PD, M739A1	E0640	HOWITZER TOWED 105MM M101A1	0	75.0210	0
N340	FUZE, PD, M739A1	E0665	HOWITZER, TOWED 155MM, M198	18	20.0685	361
N464	FUZE PROXIMITY M732	E0640	HOWITZER TOWED 105MM M101A1	0	24.0450	0
N464	FUZE PROXIMITY M732	E0665	HOWITZER, TOWED 155MM, M198	18	4.5200	81
N523	PRIMER, PERCUSSION, M82	E0665	HOWITZER, TOWED 155MM, M198	18	91.3037	1643
N600	FUZE, PD-CP, MK399-0	E0665	HOWITZER, TOWED 155MM, M198	18	0.3856	7
PC07	MIM-23F, HAWK	E0941	LNCHR, ZERO LENGTH, GM, HAWK	0	1.2567	0
PL87	FIM-92D, STINGER (RMPi) w/o GS	E1837	STINGER NIGHT SIGHT	0	0.3100	0
PM80	GM, DRAGON-2, MK 1	E0310	DRAGON DAY/NIGHT TRACKER	0	0.1833	0
PV18	BGM-71F, TOW-2B	E0935	LAUNCHER, TUBULAR, TOW	48	0.4033	19
PV18	BGM-71F, TOW-2B	E0942	LAV ANTI-TANK	0	0.4333	0

Ammunition Footprint Computation

DODIC	GCE DOS	U/P	BOX WT LBS	TOTAL LBS
A011	23	240	47.00	47
A059	54136	1680	80.60	2660
A063	7269	1640	64.80	324
A064	43343	800	72.00	3960
A131	23894	800	71.20	2136
A136	216	920	70.80	71
A363	473	2000	75.00	75
A400	0	2400	92.00	0
A475	0	2000	112.00	0
A518	6747	200	75.80	2577
A576	15906	200	75.80	6064
A590	0	170	72.00	0
A606	0	200	75.80	0
A974	0	55	146.50	0
A975	0	55	146.50	0
B504	56	44	38.90	78
B505	26	44	38.90	39
B506	26	44	38.90	39
B508	22	44	38.90	39
B509	26	44	38.90	39
B535	83	44	34.10	68
B542	10475	48	59.50	13031
B546	877	72	63.60	827
B642	276	16	184.00	3312
B643	645	16	50.00	2050
B646	167	16	44.10	485
B647	275	16	44.10	794
C380	26	1	64.40	1739
C445	0	2	126.00	0
C477	0	2	126.60	0
C479	0	2	126.00	0
C508	0	2	121.00	0
C524	0	2	160.00	0
C542	0	2	126.60	0
C787	25	1	75.00	1950
C868	596	3	53.00	10547
C869	1391	3	53.00	24592
C870	187	3	54.80	3452
C871	380	3	63.70	8090
C995	98	5	113.00	2260
D003	48	48	114.10	228
D501	26	8	874.00	3496
D502	45	8	874.00	5244
D505	105	8	781.00	10934
D510	9	1	206.00	1854
D514	41	8	882.00	5292
D515	29	8	882.00	3528
D528	44	8	802.00	4812
D532	359	1	59.77	21457
D533	326	1	42.40	13822
D540	181	2	28.50	2594
D541	778	1	32.00	24896
D544	347	8	797.00	35068
D550	47	8	825.00	4950

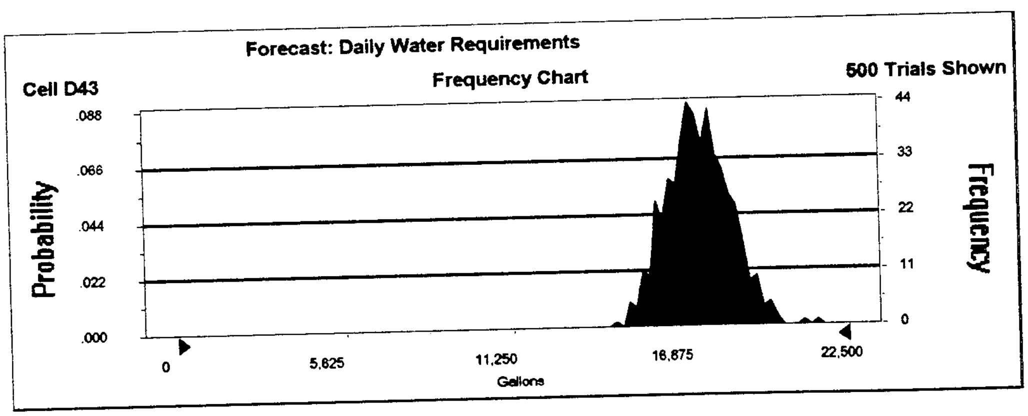
D563	484	8	830.00	50630
D579	102	8	830.00	10790
D864	216	8	830.00	23240
G826	177	8	16.40	377
G881	261	30	66.00	594
G930	21	16	40.50	81
G940	21	16	40.50	81
G945	21	16	40.50	81
G950	10	16	35.90	36
G955	21	16	35.90	72
H104	0	1	5,078.0	0
HX05	48	3	40.20	683
HX06	48	3	40.20	683
J143	0	1	200.00	0
K092	0	4	47.70	0
K143	0	6	57.50	0
K180	0	1	52.10	0
K181	0	4	153.80	0
K250	0	2	71.80	0
K867	8	1	60.00	540
L283	0	36	90.00	0
L306	4	36	71.10	71
L307	9	36	71.10	71
L311	4	36	71.10	71
L312	18	36	71.10	71
L314	10	36	71.10	71
L323	3	36	71.10	71
L324	3	36	71.10	71
L495	63	32	63.60	127
M023	0	150	46.60	0
M028	0	1	204.00	0
M032	0	48	64.30	0
M039	0	1	55.90	0
M130	0	900	117.00	0
M131	341	3600	72.00	72
M420	0	3	70.90	0
M421	0	1	31.60	0
M456	1085	2000	66.00	66
M591	0	100	62.00	0
M670	568	4000	108.00	108
M757	21	2	61.10	672
M766	206	300	60.90	61
M913	0	1	3,000.0	0
ML03	567	200	56.00	168
ML25	0	1	2,450.0	0
N289	1038	16	76.80	4992
N290	73	16	76.80	384
N340	361	16	55.68	1281
N464	81	16	70.00	420
N523	1643	500	62.00	248
N600	7	16	76.80	77
PC07	0	1	3,351.0	0
PL87	0	1	85.00	0
PM80	0	1	78.00	0
PV18	19	1	80.20	1604
	Total STONS for Class V(W)			164

APPENDIX F. CRYSTAL BALL SUMMARY REPORTS

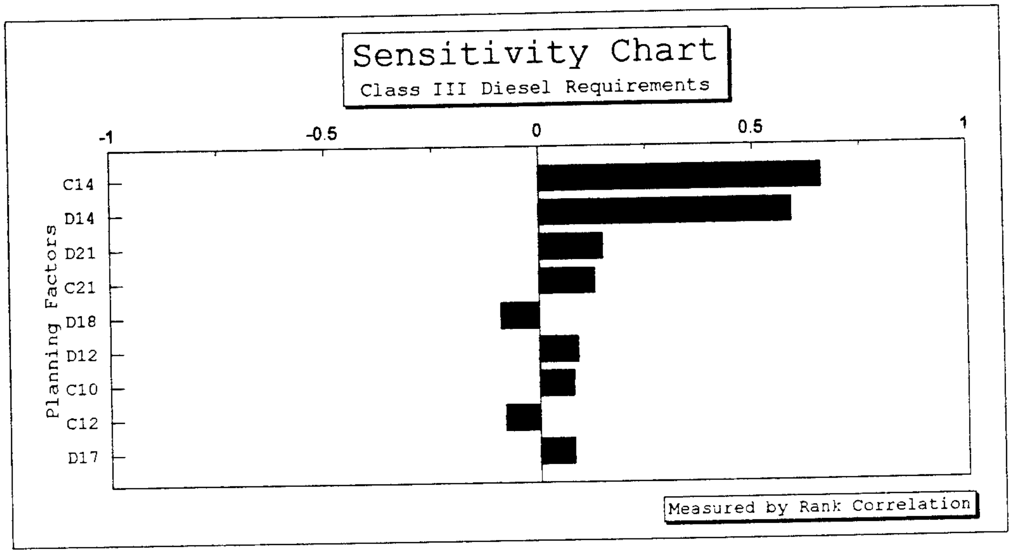


Forecast: Daily Water Requirements w/ Normal Distribution

Statistics:	Value
Trials	500
Mean	17,540
Median (approx.)	17,535
Mode (approx.)	17,152
Standard Deviation	993
Variance	985,521
Skewness	(0.02)
Kurtosis	2.91
Coeff. of Variability	0.06
Range Minimum	14,749
Range Maximum	20,272
Range Width	5,523
Mean Std. Error	44.40

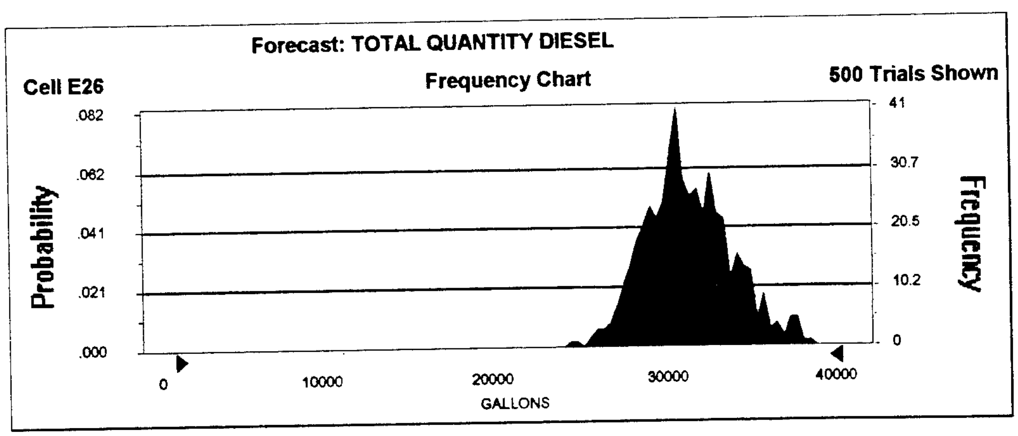


Crystal Ball Report

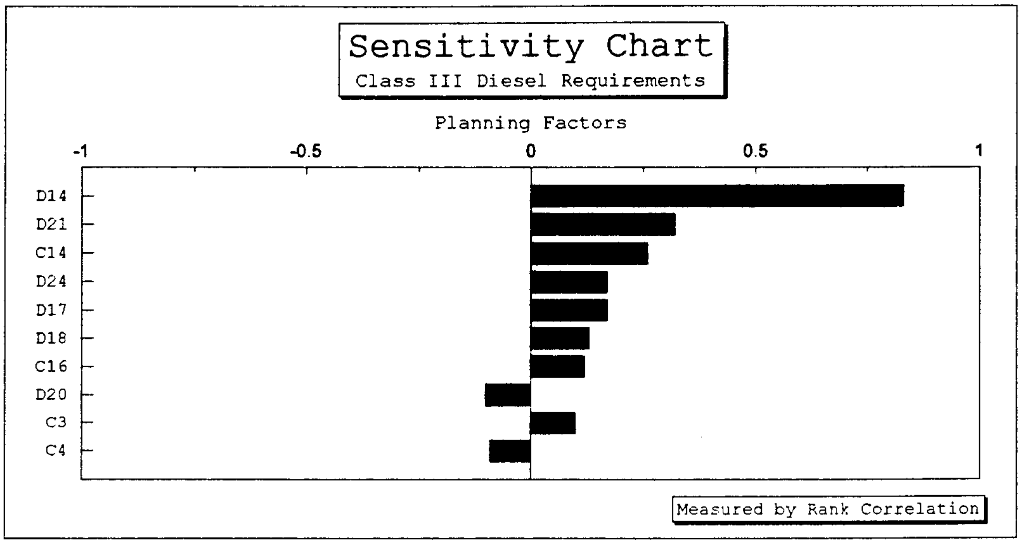


Forecast: Total Quantity Diesel w/ Normal-Normal Distribution

Statistics:	Value
Trials	500
Mean	30903
Median (approx.)	30688
Mode (approx.)	30316
Standard Deviation	2589
Variance	6704991
Skewness	0.26
Kurtosis	2.86
Coeff. of Variability	0.08
Range Minimum	23966
Range Maximum	38235
Range Width	14269
Mean Std. Error	115.80

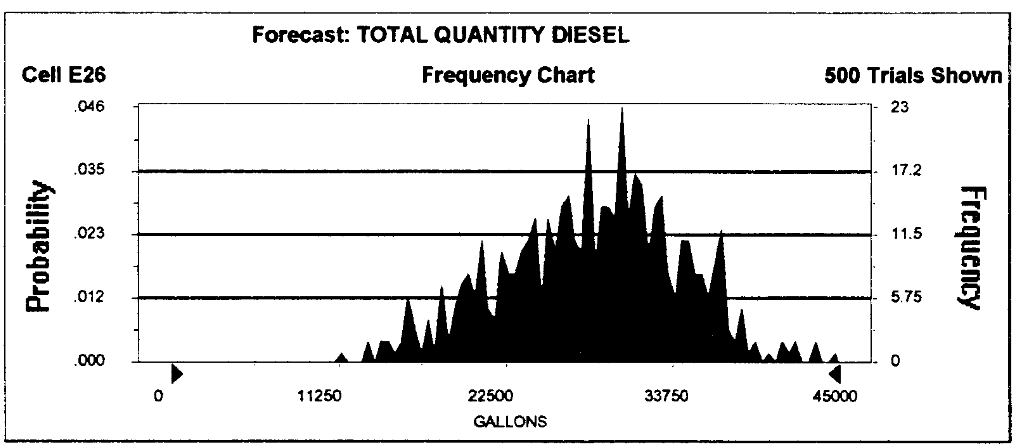


Crystal Ball Report

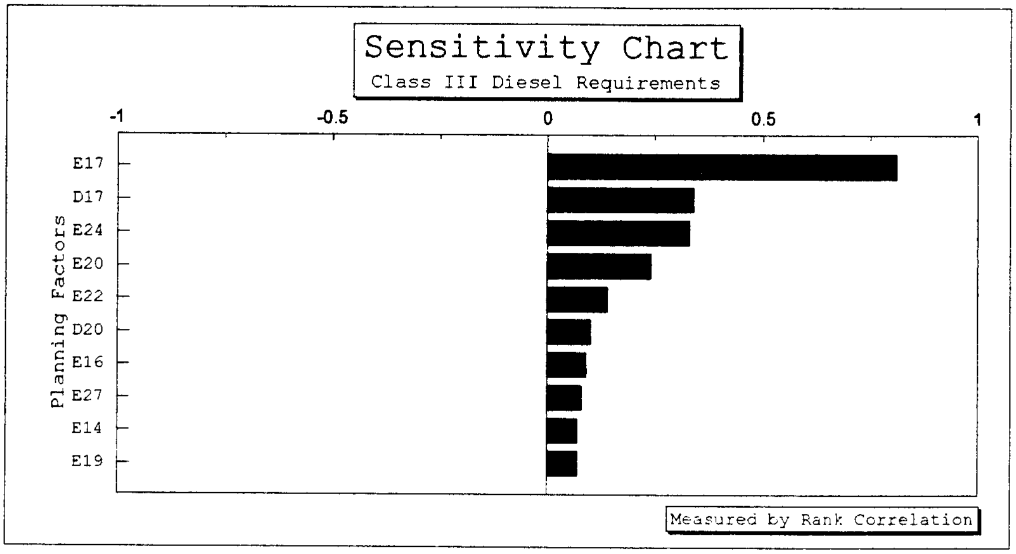


Forecast: Total Quantity Diesel w/ Normal-Triangle Distribution

Statistics:	Value
Trials	500
Mean	28328
Median (approx.)	28771
Mode (approx.)	30220
Standard Deviation	6014
Variance	36165833
Skewness	(0.20)
Kurtosis	2.69
Coeff. of Variability	0.21
Range Minimum	11571
Range Maximum	44578
Range Width	33008
Mean Std. Error	268.95

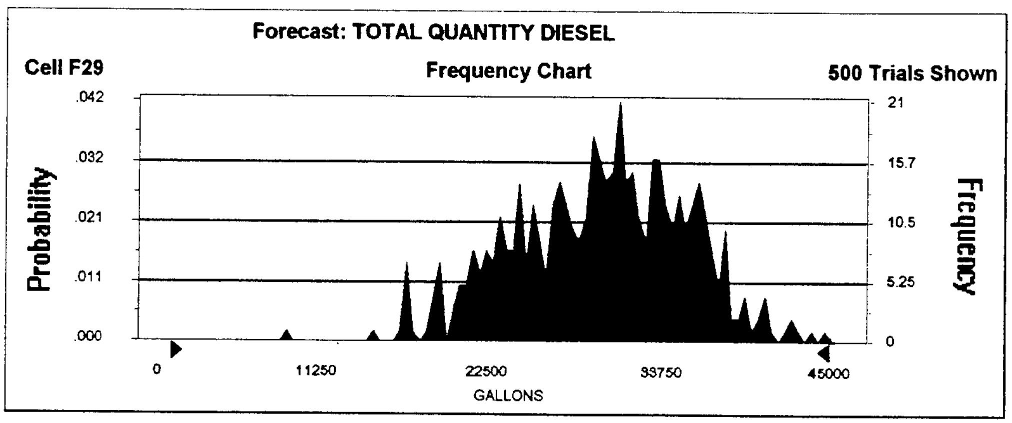


Crystal Ball Report

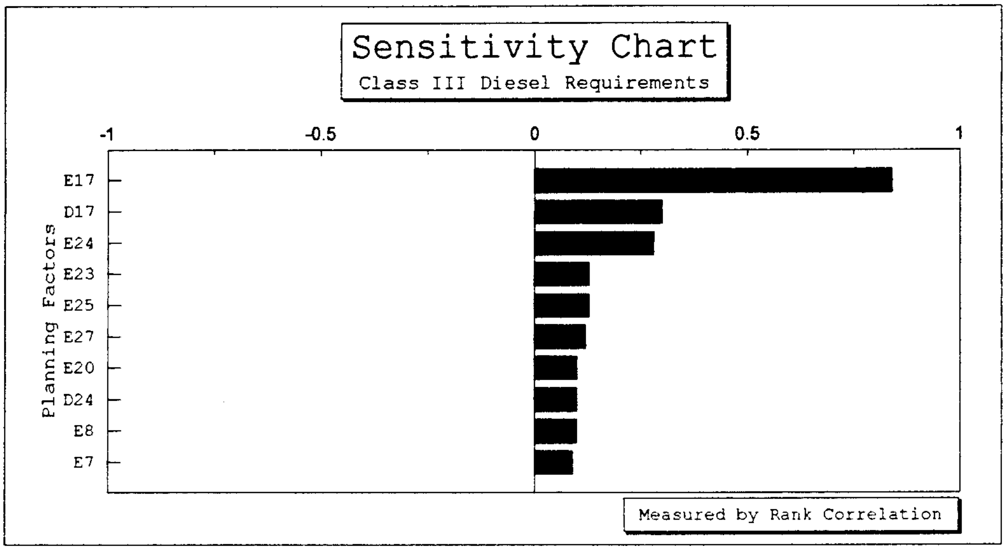


Forecast: Total Quantity Diesel w/ Normal-Beta Distribution (Alpha = 2)

Statistics:	Value
Trials	500
Mean	29070.52
Median (approx.)	29463.09
Mode (approx.)	30399.24
Standard Deviation	5871.168
Variance	34470614
Skewness	-0.22807
Kurtosis	2.717143
Coeff. of Variability	0.201963
Range Minimum	7870.707
Range Maximum	44502.46
Range Width	36631.76
Mean Std. Error	262.5666

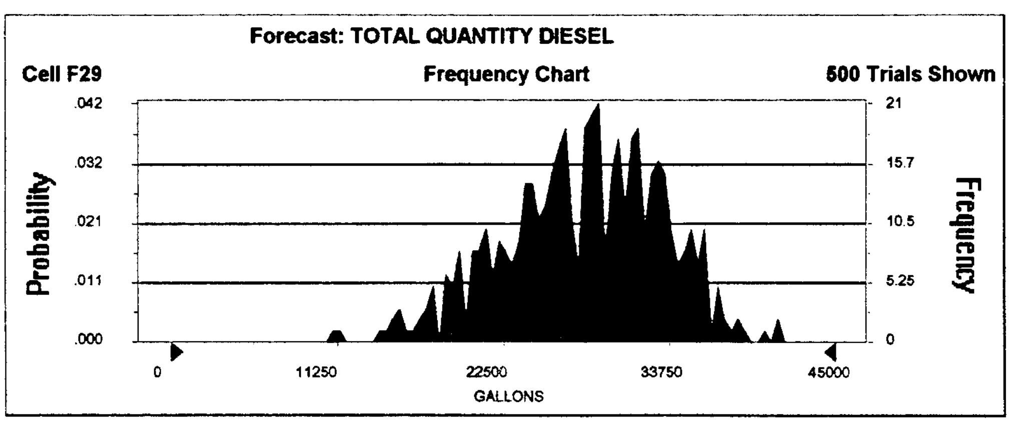


Crystal Ball Report

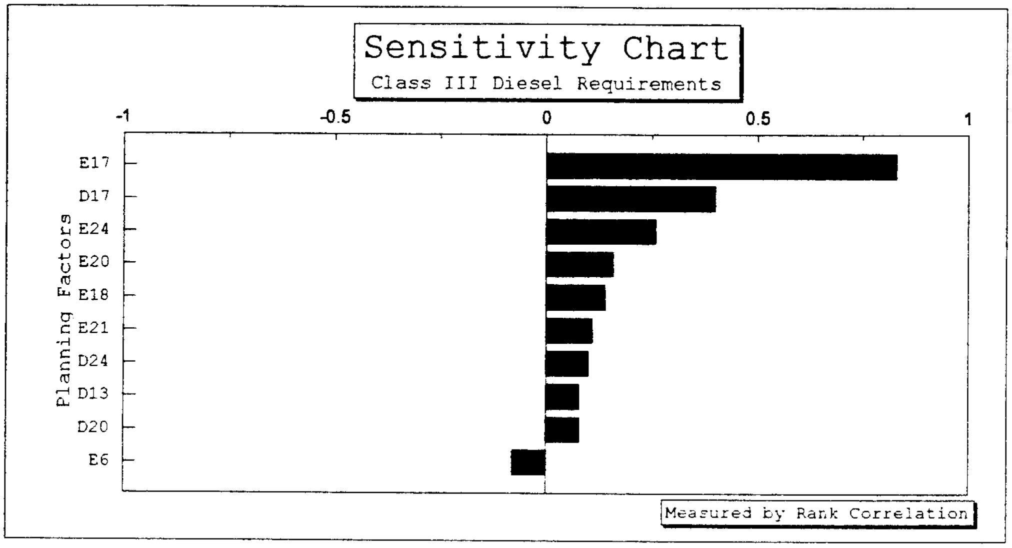


Forecast: Total Quantity Diesel w/ Normal-Beta Distribution (Alpha = 3)

Statistics:	Value
Trials	500
Mean	27981
Median (approx.)	28415
Mode (approx.)	29067
Standard Deviation	5336
Variance	28471817
Skewness	(0.33)
Kurtosis	2.74
Coeff. of Variability	0.19
Range Minimum	11159
Range Maximum	41256
Range Width	30097
Mean Std. Error	238.63

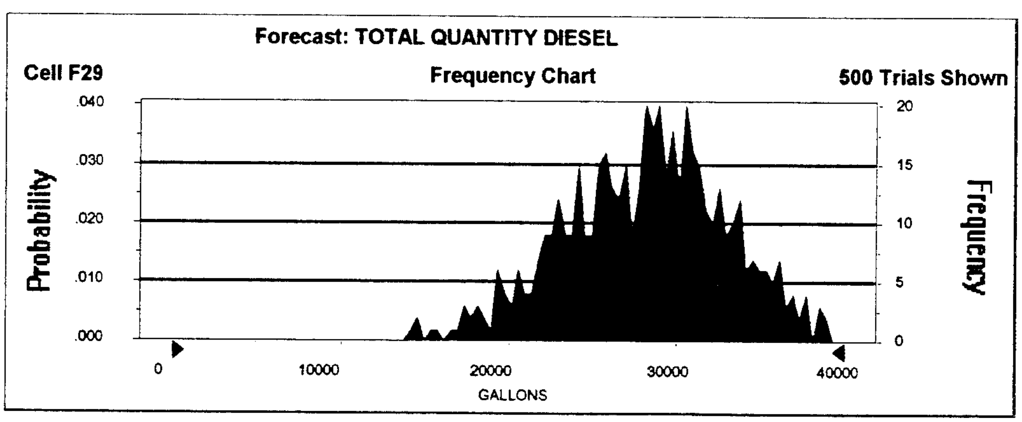


Crystal Ball Report

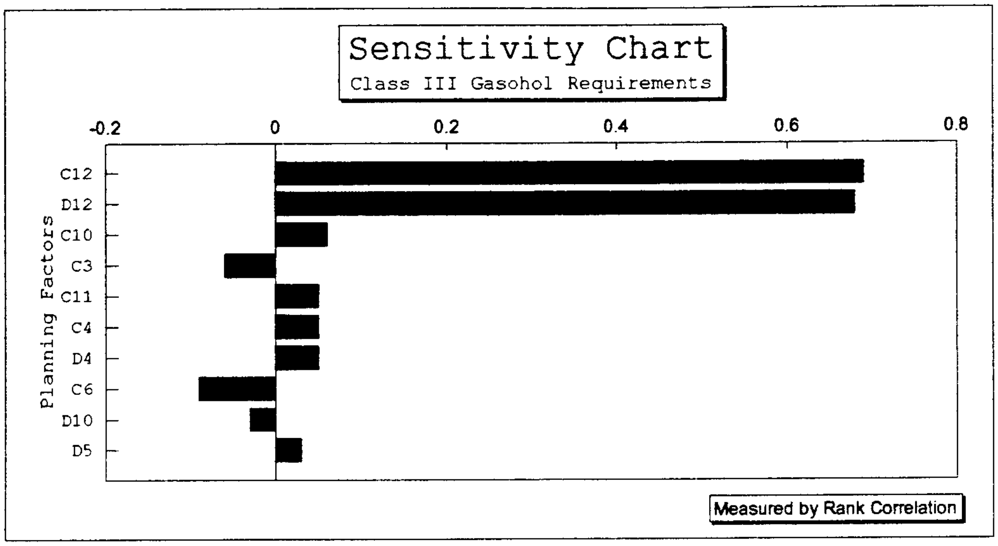


Forecast: Total Quantity Diesel w/ Normal-Beta Distribution (Alpha = 4)

Statistics:	Value
Trials	500
Mean	28161
Median (approx.)	28517
Mode (approx.)	25991
Standard Deviation	4848
Variance	23503192
Skewness	(0.23)
Kurtosis	2.74
Coeff. of Variability	0.17
Range Minimum	14058
Range Maximum	39180
Range Width	25121
Mean Std. Error	216.81

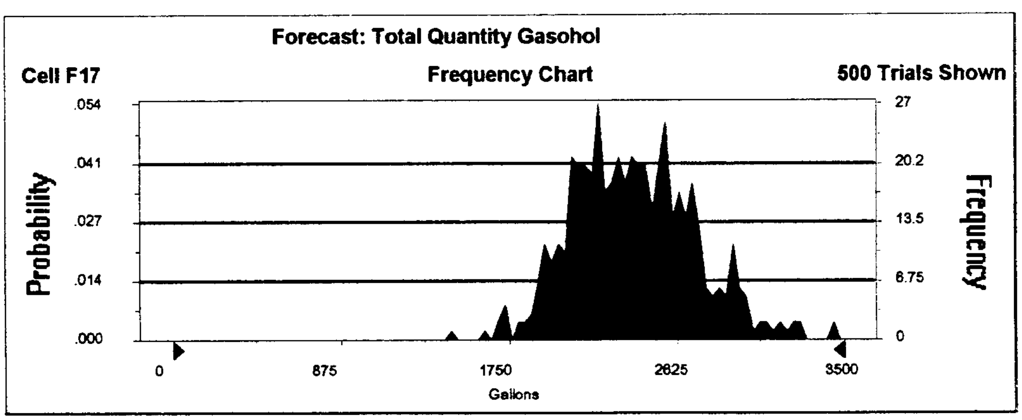


Crystal Ball Report

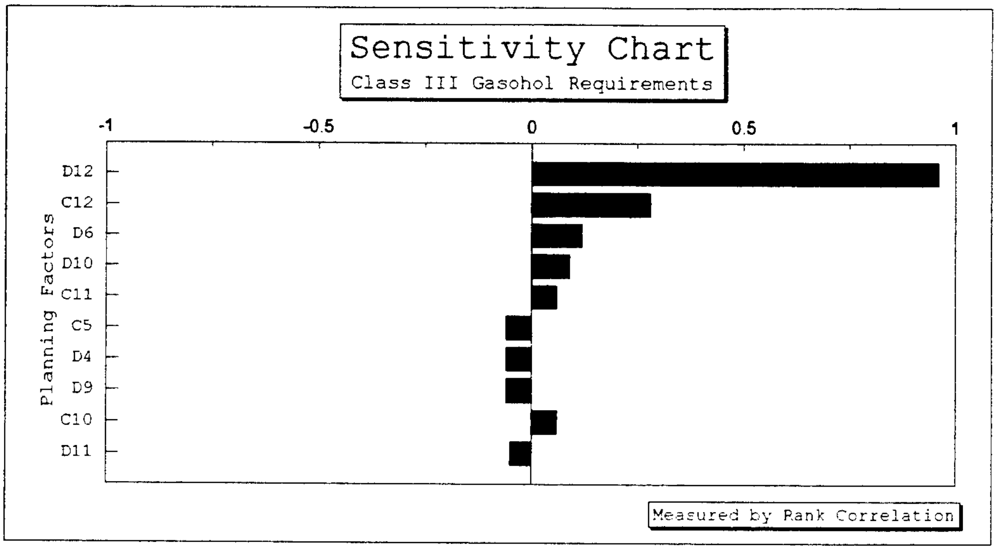


Forecast: Total Quantity Gasohol w/ Normal-Normal Distribution

Statistics:	Value
Trials	500
Mean	2412
Median (approx.)	2406
Mode (approx.)	2391
Standard Deviation	305
Variance	93084
Skewness	0.16
Kurtosis	2.76
Coeff. of Variability	0.13
Range Minimum	1616
Range Maximum	3441
Range Width	1825
Mean Std. Error	13.64

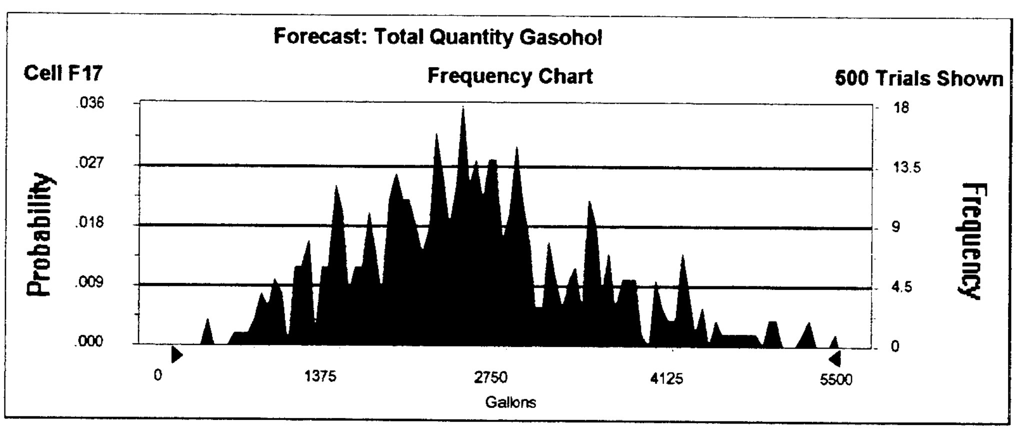


Crystal Ball Report

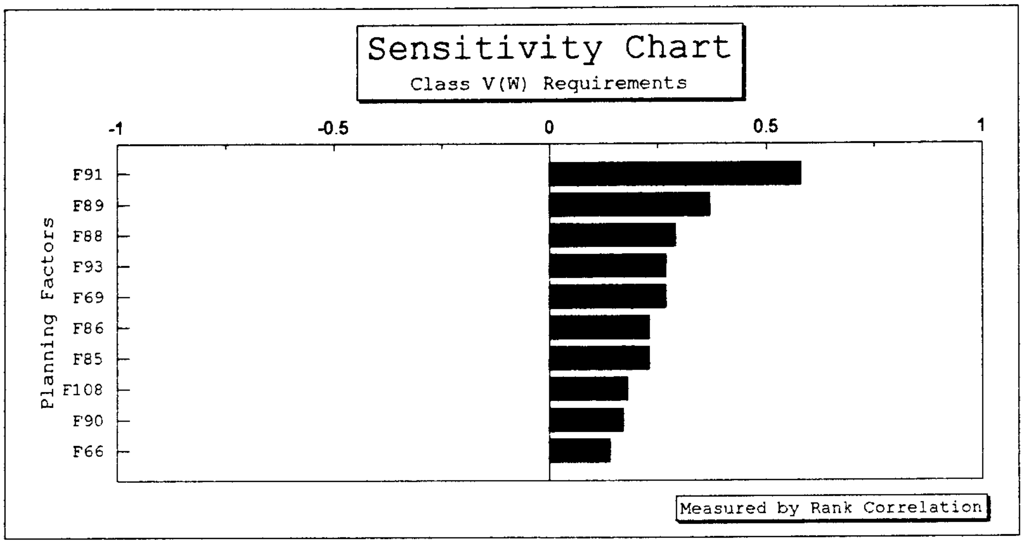


Forecast: Total Quantity Gasohol w/ Normal-Triangle Distribution

Statistics:	Value
Trials	500
Mean	2474
Median (approx.)	2404
Mode (approx.)	2194
Standard Deviation	972
Variance	943830
Skewness	0.40
Kurtosis	2.89
Coeff. of Variability	0.39
Range Minimum	284
Range Maximum	5378
Range Width	5095
Mean Std. Error	43.45

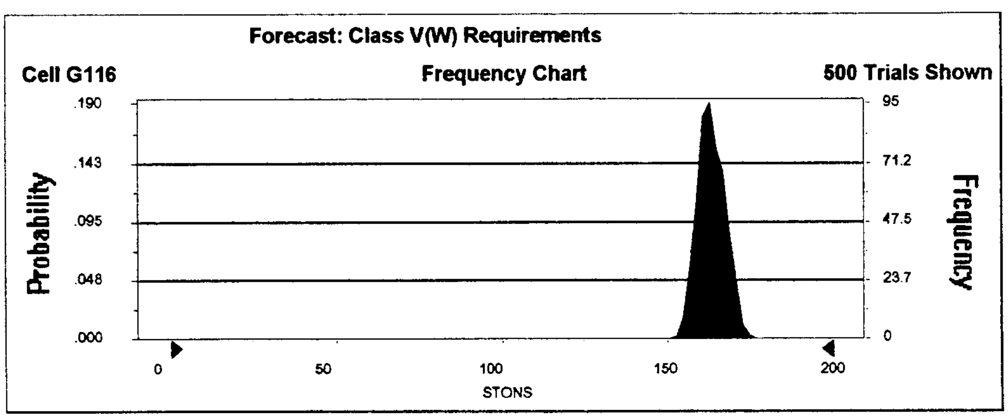


Crystal Ball Report



Forecast: Class V(W) Requirements w/ Normal Distribution

Statistics:	Value
Trials	500
Mean	164
Median (approx.)	163
Mode (approx.)	162
Standard Deviation	4
Variance	16
Skewness	0.14
Kurtosis	2.62
Coeff. of Variability	0.02
Range Minimum	153
Range Maximum	175
Range Width	22
Mean Std. Error	0.18



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